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Part I.—Original Articles.

THE TWENTY-SECOND MAUDSLEY LECTURE: PSYCHIATRY IN THE CRIMINAL COURTS.*

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THOSE responsible for these lectures took their courage in both hands when they chose me to follow in the line of the eminent doctors and lawyers who preceded me. For I am in no way a Very Important Person. I held the lowest of judicial offices, though in my opinion one of the most important. But while emphasizing your courage, I want to assure you very sincerely that I am fully conscious that it is a great honour to be selected for this task. Indeed, I am somewhat overawed, but I can only try my best.

This paper will, I gather, be classified as one of the "popular lectures" for which Dr. Maudsley so wisely and generously provided. But I should warn you that most of the opinions that I shall express will not be at all popular in my own profession; I must not be regarded as typical of either lawyers or metropolitan magistrates. Only one of your specialists could explain why early in my professional career I began to doubt many of the assumptions and beliefs in which I was legally nurtured and why, as a magistrate, I was not content with traditional methods of dealing with law-breakers, but explored new fields, where I found modern psychology. Because I thus ploughed a lonely furrow, I had many difficulties to face and at times became unpopular with my elders and betters. However, Lord Macmillan, a great lawyer of our times, said this in his Maudsley Lecture of 1934:

> "The prophet has always been greeted with a volley of stones, for, to quote Prof. Whitehead, 'routine is the god of every social system.' He who would upset that routine is treated as a heretic and blasphemer."

While I make no claim to be a prophet, I accept the label "heretic," if applied to my magisterial methods, because in my low-lying field I tried to leave my work in a better condition than it was when I began.

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* Delivered before the Royal Medico-Psychological Association, 12 November, 1948.

A great lawyer of the previous generation, Mr. Justice Fitzjames Stephen, once wrote this: "I think it highly desirable that criminals should be hated, that the punishments inflicted upon them should be so contrived as to give expression to that hatred."* This, of course, is the antithesis of the teaching of psychiatry; but to a large extent this is still the attitude of our criminal courts and of the law itself. Happily some big changes have taken place. Thus in regard to offenders under the age of seventeen, the law to-day prescribes that "every court in dealing with a child or young person . . . shall have regard to the welfare of the child or young person and shall in a proper case take steps . . . for securing that proper provision is made for his education and training."† This is the opposite of the view quoted above, and possibly Stephen himself would have been willing to make this exception to his general rule. While I think that Juvenile Courts have sometimes been too weak and sentimental with delinquent youths, I rejoice, and I am sure that you do also, in the principle thus expounded. While offenders of 17 to 21 have no such protection, the general aim of the authorities is to keep them out of the ordinary prisons. The recent Criminal Justice Act shows clearly that this is so. So far the courts have not accepted this aim, for the latest report of the Prison Commission states that in 1946 no less than 2,726 youths and 391 girls were sent to prison; of these 33 per cent. of the youths and 28 per cent. of the girls were not known to have had previous convictions.

It would be difficult to deny that for adult offenders the principles of Fitzjames Stephen still have much force. But to some extent they have been modified, mainly by the probation system, which is the most hopeful and constructive, and incidentally the cheapest way of dealing with offenders. With the exception of murder and a few such like offences, all criminal courts have the power to place all offenders on probation. This usually means that they remain with their friends and their relations, continue at work and are placed under the supervision of Probation Officers, who befriend them, but bring them back to the court if they do not make good use of the opportunities thus given them; then the courts still have the same powers of punishment that they had at the trial. Countless offenders have found their way back to a useful life in this way.

For those adults whom courts cannot deal with in this way Stephen is still apt to rule. Judges, Recorders and magistrates may be forgiven, I hope, if they have feelings of hatred towards some of the offenders who come before them; for the deeds that are unfolded in court sometimes reveal the depths of degradation, and many offenders seem unrepentant, and even defiant. Possibly, if all those on the criminal Bench were psychoanalysed they would succeed in becoming entirely impersonal and imperturbable. But I doubt whether a Bench thus raised high above the general level of humanity would receive the respect of the public, unless, of course, everybody could receive the same treatment. Judicial anger at deeds of great evil can be tolerated and viewed with sympathy. But what does not deserve either tolerance or forgiveness is such anger at the time of passing sentence. At that stage hatred, if still existing, should have been transferred from the evil-doer to the deed.

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* *History of the Criminal Law*, **2**, 179.

† Children and Young Persons Act, 1933, s. 44.

The prime weakness of our criminal system, one which the new Criminal Justice Act did not attempt to touch, is that sentence is so often passed within a few minutes after the decision about guilt. There are exceptions, among which are in general the Courts of London and some of the bigger cities. But in most parts of the country—at Assizes, at Quarter Sessions and at Magistrates' and even Juvenile Courts—sentence follows verdict too quickly. Thus information about offenders, both social and, where necessary, medical, has usually to be obtained from inquiries made before trials take place. It has always seemed strange to me that our criminal courts have tolerated such inquiries, for one of the main principles upon which our criminal law is based is that an accused person is innocent until he has been proved guilty. To me it has long seemed intolerable that police and probation officers make investigations about home conditions, the nature of employment and the record at work of an accused before the courts have decided whether he is guilty of the crime alleged against him. Such pre-trial inquiries are usually superficial, so that the information given to the court, when a verdict of guilty has been pronounced, becomes inadequate. Thus courts are led to form their own impressions of the state of an accused person from watching him during the trial. A more dangerous method of obtaining an opinion could scarcely be imagined. An elementary knowledge of the principles of psychiatry would deter those on the Bench from making such assessments of human personality. If an accused appears truculent, the reason may be what psychiatrists term a " reaction character trait " ; and the same can apply to other types of accused.

This matter is so important that I hope that you will bear with me when I take a brief glimpse at the methods of each kind of court.

Number 11 of the Rules made under the Children and Young Persons' Act prescribes the following procedure when guilt has been established :

> " The court shall, except in cases which appear to it to be of a trivial nature, obtain such information as to the general conduct, home surroundings, school record and medical history of the child or young person as may enable it to deal with the case in his best interests, and shall, if such information is not fully available, consider the desirability of remanding the child or young person for such inquiry as may be necessary."

So the official Rules themselves authorize the obtaining of the necessary information before the question of guilt has been decided. But at least they do direct the mind of the Bench to the wisdom of having this information before the decision of the court is made about the future of the defendants. But what are the results in practice ? Miss Winifred Elkin wrote, in 1938, an excellent book on the methods of Juvenile Courts. In this book she stated that " the home inquiries are made and the school reports sent up before the case is heard, and, unless there are special circumstances that make a remand advisable, the Bench reaches its decision on the child's first appearance in court." This is still true to-day. In the best courts such adjournments are made as a general rule, but such courts are the exception.

The position in adult Magistrates' Courts is much the same, except that there are no official Rules to govern their procedure in this matter. But in doing their work in this way magistrates are but following in the footsteps of their betters. For most Courts of Quarter Sessions and Assize Courts also act in the same way. Many Courts of Quarter Sessions and Assize Courts last for no more than a single day, even part of a day. Thus there is no time for inquiries after findings of guilt.

Sections 25 and 26 of the new Act deal with the power of Magistrates' Courts to adjourn cases after conviction and before sentence. There is now express power to do so " for inquiry into physical or mental condition." Such remand may be on bail, and while an offender is on bail there are now powers to enforce his attendance for medical inquiry. The reports of the doctors making the investigation may be submitted to courts in writing, subject to objections from the offender. But please do not believe that these sections will at long last bring about the conditions that we want. There is very little that is new in them ; in fact I and others have for a long time been doing almost everything that these sections permit. Again, these sections are optional. The Act contains nothing to prevent a court from continuing in the old evil ways and passing sentence without any medical or social inquiry quickly after the finding of guilt. Courts will still need to be educated about the wisdom of only passing sentence with full information about the offender. The burden of that education must to a considerable extent rest with those expert in abnormal conduct.

How strange can be the methods of even our highest courts, when left to themselves, is clearly shown in the official volume, *Criminal Statistics*, for the year 1938. Therein a comparison was made between the proportion of cases placed on probation at the Assizes and at the Central Criminal Court, which is the Assize Court for London and parts of the Home Counties. And here may I remind you that probation gives the best opportunities for psychological treatment ? At Assize Courts outside London the percentage of young offenders was 19 per cent., while at the Central Criminal Court it was in the same year as high as 42 per cent. The percentage in regard to *adult* offenders was 4 per cent. at Assizes and 16 per cent. at the Central Criminal Court. These are startling figures, especially as the very same judges who preside at Assizes all sit in turn at the Central Criminal Court, and thus set the tone for the other judges at that court. Why are judges more prone to use the probation system in London than at Assizes ? The answer is that in London there is enough work to make the sessions last for some weeks, and thus there is ample time for adequate inquiry, but many of the Assize Courts sit for but a short time, sometimes a single day. Thus adjournments after verdict are inconvenient, perhaps impossible.

Until the time-table of all courts is so arranged that there is time for ample inquiry after verdict, there can be only limited opportunity for enlisting psychiatric aid between verdict and sentence. Until this change takes place there will be inadequate time for the offenders to appreciate the harm that they have done, both to the community and to themselves, and thus to recognize that their sentence is deserved ; there will also be insufficient time for judicial anger to abate. Finally, there will be a continuation of the present system whereunder the sentences of our courts, whether of punishment or treatment, are not likely to be scientific, and, therefore, such as to render further crimes unlikely.

I have just used the words punishment and treatment. I do not regard these two as necessarily alternatives. The psychiatrists who helped me with my cases freely admitted that punishment has its place in treatment. As I wrote in my book, *Crime and Psychology*, wise punishment can satisfy the unconscious needs of the delinquent. He understands punishment and if his punishment is such as to win his approval, as it should, then he is on the road to rehabilitation. I am fully aware that there are some offenders whose psychological condition is such that punishment is dangerous. Hence the vital importance of the examination of offenders at the stage between verdict and sentence. When dealing with cases with some psychological abnormality, it is important that the sentence of a court shall be understood and accepted by the offender, for, as Dr. Ian Suttie wrote, " the efficacy of a prohibition is the greater, the more the prohibitor is loved as well as feared."* It may seem absurd for those on the Bench to aspire to be loved by the offenders whom they sentence, but with certain types of case this is not impossible.

Unfortunately, and mainly for the reasons that I have given, a high proportion of the sentences passed are fixed in accordance with the crime and not with the criminal. This means that the courts put to themselves the question, " What has the accused done ?," not " What is the accused like ? " As I will show, this to some extent is inevitable in the present state of society. Public opinion is highly unpsychological. When serious crimes are committed, the mood of the public is that of Fitzjames Stephen. Those who followed the discussions, both in Parliament and in the newspapers, on such subjects as capital and corporal punishment during the long pilgrimage of the Criminal Justice Act, which originally came before Parliament in 1938, can have little doubt that this is true. Courts cannot leap far ahead of public opinion. When I was dealing with cases, particularly sexual cases, on lines laid down by psychiatrists, I had to face some opposition. I remember the father of a boy who had been the victim of an indecent assault, protesting to me in court when I placed the offender on probation and arranged for his treatment at the Institute for the Scientific Treatment of Delinquency. He said that I cared more for the criminal than for his son. He would have been satisfied if I had sentenced the man to imprisonment for six months, for he could not foresee the danger to other boys that that man might become after his sentence.

When courts pass severe sentences of penal punishment, they undoubtedly satisfy the public ; possibly those on the Bench satisfy their own feelings as well. Under present conditions such sentences cannot be totally avoided, for not all offenders are suitable for treatment. Some will reject the opportunity if it is offered to them ; a few will begin treatment and fail to continue. But have we not to admit that there are crimes which, for the protection of society, have to be punished severely, even if this is against the offenders' own interests ? The fraudulent financier or solicitor, the railwaymen, lorry-drivers, postmen and others who have in their temporary custody valuable goods belonging to others, but who steal from them; the policeman who accepts bribes; the man who defrauds the income-tax authorities, and many others; surely the most ardent supporter of psychiatric treatment will admit that many such cases must suffer punishment. Otherwise, how are the companions of such men and the general public to learn that crime does not pay? If all offenders were dealt with according to their needs, why obey the law when we do not like it? Why not chance our luck? The most efficient police force cannot be a hundred per cent. successful.

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* *The Origins of Love and Hate*, p. 99.

Nevertheless, there are many crimes which in themselves indicate the necessity for psychiatric treatment. Such are all cases of sexual crime, arson and others; I am not competent to make a list: psychiatrists are. My fifteen years in the London courts have taught me that many first offenders and most second or third offenders should be offered psychiatric examination and, where necessary, treatment, whether on probation, in some institution, or, if they are dangerous, in prison.

That our criminal courts are not succeeding in separating the cases that require treatment from those that must be punished is easily shown by statistics. Of those found guilty in 1946 at Assizes and Quarter Sessions of indecent assaults on females 51 per cent. were sent to prison; so were about the same proportion of those found guilty of "indecency with males." In the same year 84 were found guilty of what the law calls "unnatural offences," and 71 of these went to prison. In regard to exhibitionism, an offence only triable in Magistrates Courts—and still dealt with under an Act of 1824—the percentage of imprisonments was better, namely, 16 per cent., but a further 57 per cent. were fined, which is also an unconstructive penalty, though sometimes inevitable.

It is interesting to note that Sir William Norwood East and Dr. W. H. de B. Hubert, in their joint report to the Home Secretary in 1939, stated that "only a psychiatrist of wide experience can exercise a wise discrimination in any particular case as to whether psychological treatment can be recommended with a reasonable chance of success, if unaided by imprisonment."* For me to say that my experience was different may tempt you to regard me as a frog blowing itself out like the ox. But in all due modesty, I did find that, without the so-called aid of imprisonment, exhibitionists were some of the most suitable subjects for probation combined with psychotherapy. I have handled scores of these men in this way, even persistent offenders. Several cases are cited in my book *Crime and Psychology*. There I described the case of an exhibitionist who had served five sentences of imprisonment for this offence before he appeared before me. This man was single and aged 58. His last act of exhibitionism lasted so long that there was time for a policeman to be fetched. This policemen became, of course, a valuable witness for the prosecution, for he, too, saw what was happening. It was difficult to use the probation system, since one of his previous appearances in court had resulted in the making of a Probation Order. But as that Order had not included any term about treatment, the Probation Officer and I clenched our teeth and decided to enlist psychiatric aid. This was during the pre-war years, when

* *The Psychological Treatment of Crime*, para. 49.

unemployment was rife, and unhappily this man had lost his work by reason of his many appearances in court. We arranged for him to stay at a hostel and to attend the Institute for the Scientific Treatment of Delinquency. He was willing to be treated. The early reports from the Institute were not encouraging, but we had to remember that our patient was nearing the age when treatment is often regarded as impracticable. After much hard work the Probation Officer was able to persuade his previous employer to engage him again, a fact that obviously facilitated the treatment, which continued for about six months. When the term of probation ended, this man had made excellent progress and the psychiatrist was hopeful, though naturally he could not go further. In fact we were able to follow the man up for two and a half years and, while he could certainly have been described as a persistent offender, all was well. I make no claims that this man was cured ; courts are not clinics and we do not aim so high as expecting cures. But he was definitely better than when we first saw him and this was as far as we could go. Our goal was to prevent our cases from repeating their offences. If we could do that, we felt that we had reason to be content.

Seeing that sexual offences can in their effect be like delayed action bombs, I learned to avoid imprisonment in every case. When offenders refused to accept psychiatric help I inflicted upon them as serious a warning as I could and then imposed a fine. But I was able to put the balance right by succeeding in tactfully persuading several men whom I was forced to acquit, owing to defective evidence, to undergo treatment.

I am sorry to have to say so, but I have been driven to the belief that our criminal courts are not, with their old-time methods, adequately protecting the public. At present they are filling our prisons so successfully that the Prison Commission has had to report that many cells, constructed for one prisoner, are now occupied by three. This is a horrible state of affairs. But even this might perhaps be tolerated, if the sentences of the courts had the desired effect of deterring offenders from continuing in a life of crime. Unhappily this is not so. Our courts do not pay adequate attention to the undisputable fact that all sentences, even life sentences, come to an end at some time.

Most calendars of busy Assize Courts or Quarter Sessions reveal cases where offenders have already undergone many sentences to prison and yet appear again on charges of serious crime. I have sent for trial countless cases of this kind. Many such cases are set out in detail in such books as Dr. Hermann Mannheim's *Social Aspects of Crime in England Between the Wars*, and Sir Leo Page's *The Sentence of the Court.* Here is a case that I have included in an article in the current number of the *Quarterly Review* :

> " I would cite a case chosen at random, a man found guilty on two charges of stealing and on one of possessing house-breaking implements by night ; he was thirty-eight. As a youth he had been sent to an Industrial School for stealing ; this may have indicated that his home surroundings were bad. After his discharge, he was sent to a Borstal Institution for burglary and stealing. When released, he committed a further crime, was found guilty and returned to Borstal. When finally discharged he continued his life of crime. When next before a court he was sentenced to prison for

three months. Later the same year a court of Quarter Sessions sent him to prison for another crime for eighteen months. He was now twenty-eight years old. Then followed two sentences, each of three months, three sentences of six months and three more sentences, each for terms not exceeding three months. Then another court of Quarter Sessions inflicted a sentence of twenty-one months. He was by this time thirty-four. When again at liberty, there was a pause, whether due to an absence of crime or to the fact that he was not caught, history does not relate ; but then came a sentence of six months and in the following year he was sent to penal servitude for three years. The next time that he appeared in court he was sentenced to one year's imprisonment and given that rather absurd title, which dates from 1824, of 'Incorrigible Rogue.' Up to this time nearly all his crimes had concerned property. But in a short time after he was discharged, he was sent to prison for nine months for committing 'grievous bodily harm.' Then came a fine, with the alternative of fourteen days in prison, for the offences of taking and driving away a car and stealing a torch from it. Within a year he was sent to prison by two other courts for three and four months respectively. Then finally the sentence recorded in the calendar for his latest crime was one of five years' penal servitude."

If that is how our courts deal with their difficult cases, are not those expert in psychotherapy entitled to demand a right to help ?

It is useless to try to apportion the blame between Parliament, for not providing an adequate criminal law and procedure, and the courts, for not enlisting scientific help. But the fact is that the public have time after time to suffer from the depredations of the same men and the police have to track them down almost equally often.

Will the new Criminal Justice Act bring about better conditions ? That, of course, depends upon the willingness of the courts to use their optional powers. Apart from sections 25 and 26, which deal with adjournments for inquiry, there is the power, set out in section 4, dealing with the insertion in a Probation Order of a requirement about mental treatment. Leaving out some of the words, this section provides this :

> "Where the court is satisfied, on the evidence of a duly qualified medical practitioner appearing to the court to be experienced in the diagnosis of mental disorders, that the mental condition of an offender requires treatment, the court may, if it makes a Probation Order, include therein a requirement that the offender shall submit to treatment."

The treatment may be by a single psychiatrist or as a resident patient, or as a voluntary patient under the Mental Treatment Act, 1930. So far as the Probation Order is concerned, treatment may not last more than a year. Some have objected to this limitation, but it has seemed to me that the doctors carrying out the treatment should be able, where necessary, to persuade the offender to continue the treatment as a free agent. Another important qualification is that treatment can only be required by a court with the consent of the offender (s. 3 (5)). As regards Probation generally, I have never regarded consent as a factor of value ; if my choice were between probation and six months in prison, I would eagerly consent to probation. But as regards medical treatment, this consent is vital, though I hope that the necessity for it will not be construed as meaning that the offender must admit his offence. Willingness to be treated should be sufficient.

Valuable as these powers undoubtedly are, they are not new, for under the old Probation Act of 1907 there was an omnibus power, which some magistrates, including myself, employed to bring in psychiatric treatment. But now that this possibility is set out in an Act of Parliament, we may reasonably hope for more extensive progress, though not for any rapid improvement. Psychiatry has yet to secure the confidence of the generality of lawyers and laymen on the criminal Bench. If courts do not make adequate use of these powers, it is to be hoped that psychiatrists will do what they can to inform enlightened opinion of their failure ; they must not be timid, for they now have the support of express words in an Act of Parliament.

But there is another task of great importance in the criminal courts that psychiatrists should undertake. Hitherto they have for the most part been content with giving help to the courts concerning their cases, when asked to do so. The time is overdue when they should take their courage in both hands and go further. Every step that is taken, both by the police and by the courts, when anyone is suspected of crime, is a subject for the consideration of psychiatrists, as well as of those immediately concerned. From the moment when the police first approach a suspect to the moments when an offender is found guilty and sentenced, psychiatrists have both the right and the duty to investigate our present procedure. For far too long the lawyers have had a monopoly. What a policeman is permitted to say to a suspect, how the charge is read to him, the methods adopted by the courts when dealing with him, the construction of the court, all this needs investigation from the psychological angle. There is an urgent need for a thorough and detailed examination by a group of psychiatrists—preferably of different schools—into the whole of criminal procedure. I have already referred to one vital matter about which the help of psychiatry is essential, namely, the interval between verdict and sentence, and the use that should be made of it. Many other matters await inquiry. In such inquiry psychiatrists will find much that is admirable, for criminal justice is no "Lawgean Stable," if I may borrow an old witticism. But constructive criticism from well-informed psychiatrists can help to convert the good into the better.

The traditional conception of a trial in our country is too much like a sporting contest in which prosecution and defence wrestle according to judicial Queensberry Rules, with the Bench acting as referee. Our system has the inestimable virtue that the conviction of an innocent person is extremely unlikely and in any proposals for reform, this virtue must in no way be tarnished. But our system undoubtedly results also in the acquittal of numbers who are a menace to the public ; it offers too many loopholes through which the guilty can slip and thus, with the help of clever lawyers, escape their deserts and their chances of constructive treatment. Our system places too high a value on advocacy. Biographies of famous advocates usually tell with pride of the cases where verdicts of "Not Guilty" were obtained in circumstances where the evidence seemed to point to conviction. It is safer to speak of the past. Here is a quotation from the memoirs of the first Chief Magistrate under whom I served, Sir Chartres Biron :

> " Geoghegan's technique was masterly. Without any material he would manage to create an atmosphere of suspicion round your case which, as it was entirely baseless, was very difficult to dispel. . . . He was a master of the supreme art of diverting an issue."

Sir Chartres then set out a case where, in his own words, " the case was very clear. To the evidence there seemed no answer." But Geoghegan introduced a completely irrelevant point and, to quote again, " this he did with such skill that he made this fact seem an essential point in the prosecution." He secured a verdict of acquittal and Sir Chartres comments : " It was an amazing verdict, a legitimate triumph of advocacy at its best."* This is not an exceptional case ; there always are several Geoghegans.

Without in any way endangering the innocent, more could be done to bring the guilty to justice. Lawyers may well be content with an acquittal against the balance of the evidence, but to psychiatrists this may appear as a failure to provide treatment for one who is a danger to the community. When, for instance, a man who has sexually assaulted a child is acquitted through clever advocacy, directed to the difficulties of young children in court—and these are not unusual happenings—psychiatrists will see a failure of opportunity to treat a dangerous man and the consequent peril for other children.

In their inquiry into the working of our criminal procedure, psychiatrists will need to remember that our courts can decide the facts when accused people strenuously deny the charges made against them and even when they and their witnesses lie heavily with the object of defeating justice. I know of no psychological method of doing this, though some day, perhaps an improved encephalogram may be able to compete with the courts. Until this happens, the main study of the psychiatrists will be how, while retaining ample protection for those who deny the accusations made against them, to find sound reforms which will provide greater protection for the community and be more likely to change the attitude of those who have committed serious crimes. It is possible that, when psychiatrists have made their examination into the practical working of our penal system, they will come to agree with Dr. R. D. Gillespie when he said :

> " The impression that a psychiatrist is apt to get of court proceedings is that of a ' fact-finding commission ' . . . a commission whose scope of reference is unsatisfactory and limited and whose recommendations as to treatment in consequence are likely to suffer from as grave defects as would the prescriptions of a doctor who is forbidden to have any knowledge of his patient's constitution."†

Psychiatrists will quickly discover, if they do not know it already, that our offenders are sentenced in all courts by those who have had no training for this part of their duties. This fact was realized many years ago, among others, by Dr. R. M. Jackson, in his book *The Machinery of Justice in England*. There he stated :

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* *Without Prejudice*, pp. 126–7.

† *Medico-Legal Review*, April, 1939.

> "An 'experienced' judge means one who is well used to trying defendants and who, generally speaking, makes an excellent job of that side of his duty. But when we come to the passing of sentence, our 'experienced' judge is experienced merely in making up his mind and delivering sentence with complete composure."*

A Royal Commission has recently recommended the training of magistrates. Where is the man who will be bold enough to recommend the education of judges and recorders? So one of the matters that will be on the agenda of our inquiring psychiatrists will be the wisdom of transferring the sentencing power to an expert Treatment Board, or of combining the services of such a Board with the sentencing powers of the courts, as is now being proposed by the Federal Judges in the United States of America.†

Among the other fields for inquiry will be the following: (*a*) The duty of the police, under what are called the Judges' Rules, to caution a suspect when he begins to explain his actions. This caution often results in the silence of the suspect and, therefore, his trial becomes more difficult. (*b*) The better selection of magistrates, about which the Royal Commission just mentioned, has reported. Probably the experience gained during the war in the selection of officers will provide much help in this quest. (*c*) The position of experts who give evidence about the mental condition of accused persons. Possibly better results would be achieved, if such experts could be called by the courts and thus be available for cross-examination by both prosecution and defence. Such cross-examination would probably be less bitter than at present, when experts are called by one side. (*d*) The practical working of the law of evidence and the extent to which it can be used for the suppression of facts. (*e*) The fitness of juries to decide questions of self-responsibility and whether the issue of insanity should not be dealt with by experts before a trial takes place. (*f*) The possibility of placing courts in certain cases under an obligation, when guilt has been proved, of obtaining social and psychiatric reports. For this there would have to be compulsorily the delays between verdict and sentence for which I have pleaded.

These are but samples of the problems of the tasks that would lie before a body of psychiatrists in their investigations into criminal procedure. In carrying out such a task psychiatrists must be prepared for some lack of sympathy, and even active opposition, from those who preside or plead in criminal courts. But the present large numbers of recidivists would place them on strong ground, and if they remember the words of Lord Macmillan, which I quoted in opening, they can take courage and pursue their self-appointed task. They will be supported by a considerable body of opinion outside the law and may receive some help from those within.

I would end with a brief glimpse into the distant future, when full use is made of the science of psychiatry in the task of dealing with those who break the criminal law. In proportion as constructive treatment is accepted and the use of penal punishment diminished, those who have committed crime will be more likely to admit their offences. It is largely the fear of punishment that to-day deters offenders from confessing and encourages them to seek the aid of lawyers skilled in advocacy. When the prospect before them is treatment, and not blind punishment, they may well be frank with police and courts ; we may even reach the stage when offenders themselves will realize that their acquittal is contrary to their own interests. When this somewhat utopian era is reached, will there not be a far greater protection for the public ? Then the question may arise whether for those who admit their offence, any public appearance in court will be necessary. Such prospects may alarm those who earn their living in the defence of accused people. But if they, too, move with the times, and study psychiatry as well as law, they need not fear ultimate unemployment, for the sentencing authority, whoever they may be, may still need help in learning of the facts of the offence and of the condition of the offender. Besides, it is a human need to seek help in times of trouble. Again, there are likely still to be those who deny their offence and those who have been wrongfully accused ; they will need the services of the legal profession more or less as now. No, I can see new fields opening up for my profession and no prospects of its extinction.

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* *The Machinery of Justice in England*, p. 178.

† See my article in *Quarterly Review*, July, 1946.

As a final thought I would say this : Psychiatry will in the future, as it has done in the past, make slow progress. If any of my audience are the proud parents of a newly born baby, I do not think that that fortunate child will live to see a system of criminal law and procedure that will be in complete accord with the tenets of psychiatry. But do not be deterred by the distance that you have to travel, nor by the opposition that you are likely to face. There is so much to be done, for psychiatrists should regard themselves as those who, in the words of Milton—

" by due steps aspire
To lay their just hands on that golden key,
That opes the palace of eternity."

THE EFFECTS OF CONVULSIVE THERAPY ON THE EXCRETION OF CORTINS AND KETOSTEROIDS.*

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Electroshock therapy, first introduced to this country by Fleming, Golla and Grey Walter in 1939, has long passed its period of probation and is now universally accepted as active and effective. Yet its mode of action is still unknown. The variety of theories propounded to explain its action establishes only the degree of our uncertainty. To advance our knowledge of its mode of action has been the aim of the work described in this paper.

The work has been designed to explore the possibility that convulsive therapy may act by affecting the hormonic system of pituitary and adrenal cortex. A hormonic system so extensive can be explored only in part by one investigation: we have investigated that part which is concerned with the activities of the adrenal cortex, for here, in the body's reactions to shock and stress, is the pivot.

We have therefore attempted to answer the question: What effect does convulsive therapy have on the activities of the adrenal cortex? To this end we have studied the effects of convulsive therapy in patients on the excretions of the adrenal cortical steroids and ketosteroids.

The paper first reviews the relevant facts as they are known at the present time; it then describes the technical investigations made in order to establish the accuracy and reliability of the biological and chemical methods of assay; it then applies these methods to the series of patients and enumerates the results; finally it discusses the results and the deductions which may be drawn from them.

The Effects of Stress.

That stress affects the activities of the pituitary gland is now not doubted though most of the evidence is indirect. The changes which stress produces in various glands and organs are so similar to the changes which are produced by the various hormones of the pituitary that there can be little doubt that in many important instances the pituitary is a link in the chain between the application of stress and the changes which result. Changes in the basal metabolic rate, in the nitrogen metabolism, in the blood-sugar level, in the cholesterol and ascorbic acid contents of the adrenal cortex, in the sizes of the thyroid, adrenals, thymus and gonads, in the number of circulating lymphocytes, in the titre of circulating antibodies, in the blood chlorides, in diuresis, and in the volume of the blood, all these changes are caused both by stress and by the various pituitary hormones. It is confirmatory evidence that most of these changes fail to appear if the animal be hypophysectomized before the application of the stress.

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Though the action of stress on the pituitary can hardly be doubted, yet the route by which the stress reaches the pituitary is by no means clear. There is little doubt that all severe disturbances, whether causing pain or autonomic imbalance, cause disturbances in the centres of the hypothalamus, and it is likely that these centres are the point of departure for action on the pituitary. But the route from hypothalamus to pituitary is uncertain. Some workers, especially the Scharrers (1937), have described, in the cells of the hypothalamic nuclei, particularly in the supraoptic and paraventricular, microscopic granules which they believe to pass into the blood and to control the adenohypophysis, passing either through the main blood stream, or through the special " portal " system of veins known to link the hypothalamus and the adenohypophysis (Wislocki, 1938). This suggestion does not seem to have met with general acceptance ; and it must continue to be regarded with some scepticism until the supposed substances can be shown to exert some positive effect on the adenohypophysis ; but this so far has not been achieved.

A second possible route is by nervous conduction from the hypothalamus to the adenohypophysis, and nerve fibres have often been described purporting to demonstrate such innervation (Vazquez-Lopez, 1948). It is well known that fibres pass from the supraoptic nuclei to the neurohypophysis, but their passage to the adenohypophysis has been both claimed and disputed. The histological evidence might seem strong were it not contradicted by Uotila's experiment (1939). One of the most characteristic and best-known effects of neural stimuli on pituitary function is the effect in the female rabbit of copulation in causing ovulation ; the process is mediated through the posterior columns of the spinal cord, to the hypothalamic nuclei, then to the adenohypophysis, which secretes the gonadotrophic hormones, which evoke the ovulation. Uotila has shown that section of the stalk of the pituitary does not free the pituitary from the effects of sexual sensory stimulation, so that it seems clear, in this case, that the stimulation passes from the hypothalamus to the adenohypophysis by some route other than a neural one through the stalk.

Although the route or routes from hypothalamus to adenohypophysis are obscure, yet there is little doubt that the adenohypophysis acts as an important intermediary in these reactions to stress : for this reason it will be more convenient to discuss the actions of the adenohypophysis and the actions of its " trophic " hormones together.

In the reactions to stress a key position is held by the corticotrophic hormone, for by its appearance the whole adrenal cortical system is mobilized. Many of the effects of the corticotrophic hormone are produced secondarily by the action of the activated adrenal cortex. These secondary effects will be referred to later.

The primary effects of corticotrophic hormone occur, so far as is known, entirely within the adrenal cortex, and here its first effect was shown by Sayers, Sayers, Liang and Long (1946) to be a fall in the ascorbic acid and cholesterol contents of the cortex. This fall may be related to an output of the 11-oxy-steroids, since the work of Deane and Greep (1946) and of Swann (1940) suggests that these steroids are produced by the zona fasciculata of that gland. These effects occur rapidly, within an hour or two of the injection. If the administration is prolonged, then after a few days there commences a steady hypertrophy of the adrenal cortices.

Stress itself has also been shown by Sayers, Sayers, Liang and Long (1945) and by Levin (1945) to cause the same fall in ascorbic acid and cholesterol in the adrenal cortex, confirming that one at least of the important results of stress is mediated by a secretion of the adenohypophysis.

The results of stress are many and widespread. There are, of course, the direct and immediate results of the causative disturbance, and there are also the complex and later results due to the reactions developed by the body. In the study of these patterns of reaction the work of Selye (1937, 1942, 1946) has been pre-eminent. He proposed the thesis, which has gained wide acceptance, that the body has a mechanism for reacting to almost all types of severe general bodily stress, and that this mechanism, though complex, is essentially a unit so that a great variety of different stresses evoke only one type of response. Briefly, it has been found that adrenal cortical activity and, later, hypertrophy, regularly follow many if not all types of stress. The changes within the adrenals correspond exactly with the changes induced by corticotrophic hormone as mentioned above. But other adrenal cortical effects may also be demonstrated. Burns may raise the excretion of urinary cortins to several times their usual height (Talbot, Saltzman, Wixom and Wolfe, 1945; Talbot, Albright, Saltzman, Zygmuntowicz and Wixom, 1947; Venning and Browne, 1947); surgical operation may also increase them (Venning, Hoffmann and Browne, 1944; Talbot, Albright, Saltzman, Zygmuntowicz and Wixom, 1947); while other factors known to be capable of causing activity in the adrenal cortex are traumatic shock (Best and Solandt, 1940), obstetric shock (Matthews, 1939), "gravity" shock (Cole, 1944), muscular exercise (Selye, 1937), infectious disease (Shipley, Dorfmann, Buchwald and Ross, 1946; Kiml, 1939), haemorrhage (Feenders, 1936), and exposure to cold (Puchkov, 1937), to name only some main factors. Were there space the list could be made almost as long as the list of hurts to which the body may be subjected.

The secretion of corticotrophic hormone evokes, as we have seen, a secretion of adrenal cortical steroids. But there is also a reciprocal action, for Sayers and Sayers (1947) have shown that the adrenal cortical steroids themselves act on the adenohypophysis, inhibiting it from secreting more corticotrophic hormone. Thus, the two glands, each acting on the other, will tend to form a stable system, homeostatic in respect of the secretion of the adrenal cortical steroids. The importance of this observation will be referred to again later.

The Effects of Adrenal Cortical Steroids.

Having reviewed briefly the effects of stress and of the adenohypophysis' reaction to stress, and having found that the main response is an activation of the adrenal cortex, we shall now turn our attention to the adrenal cortical steroids in their actions on the body. Their actions are manifold. Although the various actions are all, in the teleological sense, directed to enabling the body to withstand stress, yet the physical and chemical reasons for these actions are only beginning to be elucidated.

One important activity of the adrenal cortex controls gluconeogenesis and the deposition of glycogen in the liver : processes used by us as a basis for assay. It has been known since Britton and Silvette (1932) and Eggleston, Johnston and Dobriner (1946) that the adrenalectomized rat, when fasted, loses glycogen from the liver with unusual rapidity, and has difficulty in replacing it when protein or carbohydrate is supplied. Adrenal cortical extracts can restore the normal activity, but this property is possessed only by some of the steroids. Thus, Olson, Thayer and Kopp (1944), working with pure steroids, found that, as measured by their power to promote glycogen deposition, corticosterone has a potency of 100, 11-dehydro-corticosterone of 114, 17-hydroxy-11-dehydro-corticosterone of 134, and 17-hydroxy-corticosterone of 149, while 11-desoxy-corticosterone and allopregnane-3, 11, 17, 20, 21-pentol were inactive. This pattern of potencies is very different from the pattern of potencies when measured by their power to maintain life. Thus, measured in mg./kg./day, the adrenalectomized rat needs 3·5 of corticosterone but only 0·55 of 11-desoxy-corticosterone, the latter being now over six times as effective as the former ; in the adrenalectomized dog the quantities are, respectively, 0·15 and 0·015, with the latter now ten times as effective as the former (Kendall, 1941, 1942 ; Kuizenga and Cartland, 1939 ; Kuizenga, Nelson and Cartland, 1940 ; Mason, 1939). Other workers are agreed on the orders of the potencies as measured by a particular function, though their quantitative estimations often differ markedly. Thus, Venning and Browne (1947) found 17-hydroxy-corticosterone to be, not 1·3 times, but about 3·0 times as active in glycogen deposition as 11- dehydro-corticosterone, while Dorfmann, Ross and Shipley (1946) estimated the ratio at 4 times. From these and other results there seems to be little doubt that the addition of the hydroxyl group at C-17 enhances these steroids in their glycogen-depositing activity ; but this addition does not by itself confer this activity, for there are many steroids, e.g. testosterone and α-estradiol, which possess the group but not the activity. 11-desoxy-corticosterone is quite inactive in this test (Reinecke and Kendall, 1942 ; and above), being similar to the portion of the adrenal cortical extracts known as the " amorphous fraction," which also shows little or no activity in this test (Kendall, 1942), though both are highly active in the processes of water metabolism. The inactivity in glycogen deposition of the amorphous fraction is of some importance, as it implies that the crystalline steroids, of known constitution, must be the steroids actually responsible for the glycogen-depositing power of the original extract, and possibly of the adrenal cortex itself. We shall refer to this again later.

The " work " test as used by Ingle and de Fremery, being based on the power of a muscle to do work, may be not unrelated to the glycogen-deposition test, and the parallelism of relative potencies confirms this. Ingle, for instance (Ingle and Kuizenga, 1945*a*, *b*), found that a hydroxyl group at C-11 was necessary for activity in the " work " test, and that an additional hydroxyl group at C-17 enhanced the effect.

A second activity of the adrenal cortex enables the animal to withstand extreme and prolonged cold ; and this has been used as basis for a method of assay (Selye and Schenker, 1938). But the steroids which are active in this test are by no means identical with those active in glycogen-deposition. Dorfmann, Shipley, Ross, Schiller and Horwitt (1946), for instance, using four pure steroids, found their relative activities in the "cold protection" test to be in the proportions: 17-hydroxy-11-dehydro-corticosterone 100, 11-dehydro-corticosterone 33, corticosterone 8, and 11-desoxy-corticosterone 7. Clearly the pattern is very different from that in glycogen-deposition.

A third activity of the adrenal cortex regulates the activities of some enzymes. Outstanding in its importance has been the discovery that the inhibition of hexokinase by pituitary extract is intensified by adrenal cortical extracts, and that this inhibition, intensified or not, is released by insulin (Price, Slein, Colowick and Cori, 1946). The individual steroids active in this have not been identified; corticosterone, 11-dehydro-corticosterone and 17-hydroxy-corticosterone had no effect, so the active substances are probably in the "amorphous fraction." Related to this discovery may be the work of Verzar's school (Montigel and Verzar, 1943*a*, *b*, *c*; Montigel, 1943), which maintains that the adrenal cortical steroids are primarily active in the phosphorylations. But their work has been much criticized and many adverse facts educed; Vogt (1943), for instance, studied carbohydrate metabolism and transfer in the isolated intestine of the rabbit, both normal and adrenalectomized, but she could find, in the latter, no evidence of disturbed metabolism such as must have occurred had the phosphorylations been defective. Hypophysectomy, it is true, results in a lowered alkaline phosphatase in the serum (Li, Kalman, Evans and Simpson, 1946), but it has not yet been proved that this fall is related to the atrophy of the adrenal cortices caused by the operation.

Those of the insulin-hexokinase system are not the only enzymes interacting with the adrenal steroids. Tipton (1944) has shown both that after adrenalectomy there is a lowered activity of cytochrome oxidase and of cytochrome-c, and also that the lowered activity is restored to normal on the injection of adrenal cortical extracts. Again, the individual steroids responsible have not been identified. Nor is this the only evidence that the cortical steroids are concerned in the efficiency of the oxidative systems. Both Lewis, Thorn, Koepf and Dorrance (1942) and also Thorn, Jones, Lewis, Mitchell and Koepf (1942) have shown that when the adrenalectomized rat is subjected, by a low barometric pressure, to a reduced tension of oxygen in the tissues, the administration of cortical extracts increases their resistance to this stress, possibly by increasing the efficiency of the oxidation in the tissues.

Another enzyme known to be related to the adrenal cortical steroids is the arginase of the kidney (Kochakian, 1944), but the significance of the relationship is at present difficult to determine. Folley and Greenbaum (1946) found that adrenalectomy decreases the arginase of both kidney and liver, and that this decrease can be corrected completely by 11-desoxy-corticosterone, and to a lesser extent by the C-11-oxysteroids. Similar decreases occur in the mammary glands, but there the decrease cannot be corrected by any of the steroids. There are evidently tissue, as well as chemical, specivicities.

Though the mechanisms of the adrenal cortex are closely related to the defences against stress, yet the attempt to use cortical extracts as therapeutic agents against traumatic shock has had dubious success. Much work has been done with little agreement. In the early days of the war the need for a successful treatment for shock was urgent. Many papers appeared claiming that cortical extracts gave some protection, but so many appeared reporting failure that in spite of the complexity of the subject it seems clear that cortical extracts do not directly and positively protect against shock. Among those who found that the injection of cortical extracts was of value were Noble and Collip, 1942 ; Swingle, Remington, Drill and Kleinberg, 1942 ; Katz, Killian, Asher and Perlov, 1942 ; Schleser and Asher, 1942 ; Bourque, Haterms and Glassco, 1943 ; Zarrow, 1942 ; Remington, 1943 ; Reiss, MacLeod and Golla, 1943 ; Kepl, Caldwell and Oschner, 1943 ; and Lowenstein and Zwemer, 1943 ; while among those who found them of no value were Wegria, Rojas and Wiggers, 1943 ; Huizenga, Brofman and Wiggers, 1943 ; Ingle, 1943 ; Winkler, Smith and Hoff, 1942 ; Keating, Rynearson and Power, 1942 ; Koster and Kazman, 1942 ; Semmann, 1940 ; Ingle and Kuizenga, 1945 ; Swingle, Overman, Remington, Kleinberg and Eversole, 1943 ; Fowler, 1944 ; and Cope and Moore, 1944. Swingle reviewed the subject in 1944 and concluded that no clear effect had been demonstrated. Since then there has been no reason to alter this conclusion.

All these workers were interested primarily in the effect of the adrenal cortical steroids on surgical shock. Few workers seem to have studied their effects on other forms of stress, though their ability to fortify adrenalectomized animals against the stress of prolonged cold is well recognized. Pincus and Hoagland (1944, 1945) reported that Δ^5-pregnenol-3(β)-one-20 improved the performance of human subjects to prolonged psychomotor tests, but this has been denied by Graham-Bryce, Bullen and Forbes (1945).

The other effects of the adrenal cortical steroids must be passed over as irrelevant to our purpose, though we should not omit to note the curious fact that several workers have found some cortical steroids, and particularly 11-desoxy-corticosterone, to be anti-convulsant in action (Stainbrook, 1947 ; Spregel and Wycis, 1945 ; Kerman, 1947 ; McQuarrie, Anderson and Ziegler, 1942 ; Selye, 1942), but this has been denied after careful examination by Goodman, Swinyard and Toman (1946). At present it would be premature to speculate on its possible significance.

THE METABOLISM OF THE ADRENAL CORTICAL STEROIDS.

The chemical origin of these steroids is still uncertain. The most obvious sources for them are cholesterol and the related bile acids, but a closer examination of this possibility reveals difficulties. Processes of metabolic conversion of this type usually progress by reduction from the more highly oxidized to the less, yet some of the adrenal cortical steroids are known to be more highly oxidized than their supposed precursor. Again, a hydroxyl or keto-group at C-11 is possessed by many of the adrenal steroids but not by cholesterol, yet the introduction of such a group is difficult chemically, and has not yet been achieved *in vitro*. Quite a different source has been proposed by Reichstein (1937), who offered the interesting suggestion that the steroids might be formed by the condensation of 3-carbon carbohydrate residues, such as dihydroxyacetone or glyceraldehyde, followed by reduction. But when the possibilities are as wide as these, it is clear that our knowledge is small.

The urinary cortins may be traced back with some confidence to the adrenal cortex, though the possibility of other sources cannot yet be entirely excluded. As described in a preceding section, many workers have shown that urinary cortins are much raised after surgical operation, trauma, burns, exposure to cold and other incidents known to provoke adrenal cortical activity. More direct evidence, however, was given by Dorfmann, Horwitt, Shipley and Abbott (1944) when they showed that the normal monkey excreted urinary cortins (demonstrated by the " cold-protection " test), and that the cortins fell to zero after adrenalectomy. Some support was given to the thesis of the adrenal origin of the urinary cortins by the observation that the administration of adrenal cortical extract was followed by an increase in the urinary cortins. But perhaps the most decisive evidence is that the cortins are known to show several of the most characteristic pharmacological properties of the adrenal cortical steroids: the deposition of glycogen, the protection from cold, and other properties mentioned above. Thus, there seems little reason to doubt that most of the urinary cortins are of adrenal origin.

That the 17-ketosteroids originate in part from the testis is well known, but there is also evidence that part come from the adrenal cortex. Thus, some 17-ketosteroids have been found in the adrenal cortex itself: androstene-3(β), 11(β)-diol-17-one, Δ^4-androstene-3, 11, 17-trione, and Δ^4-androstene-3, 17-dione. Further evidence of the adrenal origin of part of the 17-ketosteroids is provided by the fact that eunuchs and ovariectomized women excrete 17-ketosteroids in nearly normal amounts (Hirschmann, 1943); and also by the fact that patients with Addison's disease excrete little or none (Fraser, Forbes, Albright, Sulkowitch and Reifenstein, 1944).

Of the metabolism of the adrenal cortical steroids more is becoming known every year, but our knowledge is still meagre. By giving the pure steroid in large quantity and by isolating the excretion products, it has been shown (Cuyler, Ashley and Hamblen, 1940) that 11-desoxycorticosterone (I, Fig. 1) is converted into pregnane-3(α), 20(α)-diol ("pregnanediol") (II, Fig. 1), though the latter substance is also an end-product of the metabolism of progesterone (III, Fig. 1) (Venning and Browne, 1940). Similarly it has been shown (Pfiffner, 1942) that 11-dehydro-corticosterone (IV, Fig. 1) is converted into pregnane-3(α), 20-diol-11-one (V, Fig. 1). Other substances known to be derived from some of the adrenal steroids are pregnane-3(α), 17, 20-triol (VI, Fig. 1) (Butler and Marrian, 1937), and pregnane-3(α), 17-diol-20-one (VII, Fig. 1) (Butler and Marrian, 1937), though their compounds of origin are not known.

Of the 17-ketosteroids, testosterone (VIII, Fig. 1) is a well-known precursor, its metabolism leading to androsterone (IX, Fig. 1) (Callow, 1939), to *iso*androsterone (X, Fig. 1) (Dorfmann, 1941), to dehydro*iso*androsterone (XI, Fig. 1) (Wolfe, Fieser and Friedgood, 1941), to 11(β)-hydroxy-androsterone (XII, Fig. 1), and to *etio*cholane-3(α)-ol-17-one (XIII, Fig. 1) (Fish and Dorfmann, 1944).

All the last five are 17-ketosteroids, and are included in our assay. Some few other metabolic changes are known but are irrelevant to our purpose.

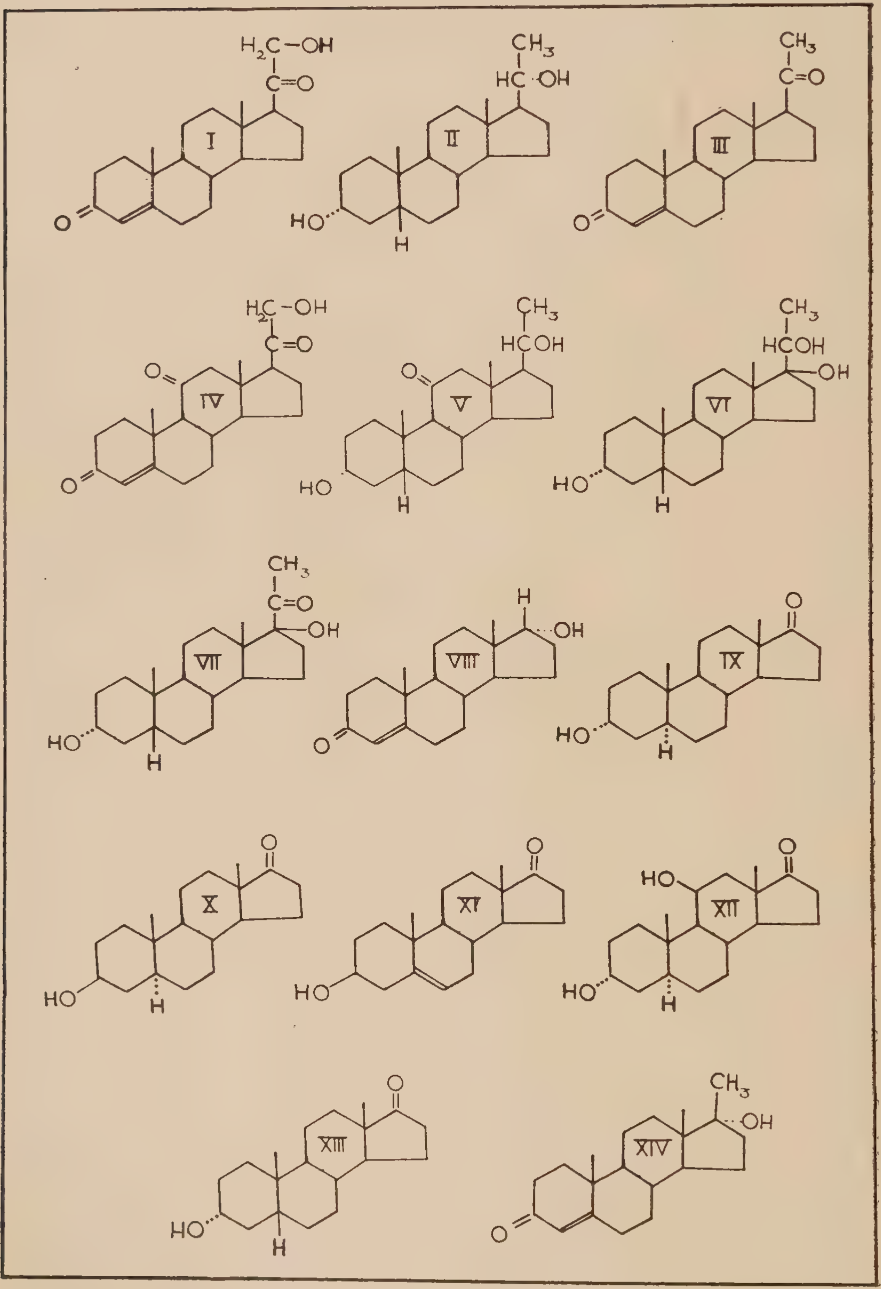
H₂C–OH
C=O
I
O
CH₃
HC·OH
II
HO
H
CH₃
C=O
III
O
H₂C–OH
C=O
O
IV
O
CH₃
HCOH
O
V
HO
H
CH₃
HCOH
–OH
VI
HO
H
CH₃
C=O
–OH
VII
HO
H
H
OH
VIII
O
O
IX
HO
H
O
X
HO
H
O
XI
HO
O
HO
XII
HO
H
O
XIII
HO
H
CH₃
OH
XIV
O

Fig. 1.—The steroids mentioned in the text.

Unfortunately, what is known contributes little to our understanding of the metabolic problems involved in our work. The steroids which compose the group of "urinary cortins" are not yet known, but it seems clear that they must include compounds other than those listed above. The outstanding property of the urinary cortins is that they are "sugar-active"; yet of the end-products described above only II has the necessary configuration of being ketonic at C-11. Again, other urinary cortins have reducing properties, yet none of the end-products described above contains a group able to reduce alkaline copper. Of the 17-ketosteroids our knowledge is better, for, of the nine end-products, no less than five (IX, X, XI, XII, and XIII) are within this class; and these may provide an appreciable part of the compounds reactive in our assay.

The simple transformations given above state only the initial and terminal compounds. It is likely that many intermediate compounds exist, and that these intermediate compounds are chemically and metabolically related in the different transformations. That such interrelations may exist is exemplified by the fact that although 17-methyl-testosterone (XIV, Fig. 1) is not itself a 17-ketosteroid, and is not excreted as one, yet when it is given, the excretion of 17-ketosteroids is diminished (Reifenstein, Forbes, Albright, Donaldson and Carroll, 1945).

Of the fate of the adrenal cortical steroids some few facts are known. The changes described above tell how some of the adrenal cortical steroids pass to compounds of other classes and thereby lose their characteristic properties.

The work of Vogt (1943), by showing that the blood in the suprarenal veins contains an amount of cortins much higher than that in the other veins, suggests that, after production, the destruction, or at least the disappearance, of the adrenal cortical steroids is rapid; and this has been confirmed in several ways. There is the well-known brevity of action of the adrenal cortical extracts, whether given therapeutically or for animal experiment. And there is the fact, demonstrated in several ways, that after the injection of adrenal cortical steroids little can be recovered from the urine. Venning, Hoffmann and Browne (1944) and Harrop and Thorn (1937) recovered less than one-tenth of the amount injected. Talbot, Albright, Saltzman, Zygmuntowicz and Wixom (1947) injected corticosterone intramuscularly at 15–60 mg. daily for three days but failed to recover any from the urine; and both these workers and also Pfiffner, Vars and Taylor (1934) failed similarly with 11-desoxy-corticosterone. Dorfmann, Horwitt, Shipley and Abbott (1944), as mentioned above, gave adrenal cortical extract and increased the urinary cortins; but the fraction recovered was small.

The site of the destruction of the adrenal cortical steroids is uncertain. Mason and Hoffmann (1945) have shown that progesterone is inactivated by the liver, but the relevance of this observation to our work is uncertain. Vogt's work (1943) suggests that the adrenal steroids, after their secretion into the blood-stream, are almost immediately absorbed by the tissues of the body, but their subsequent fates are unknown.

This concludes the survey of the relationships between the adrenal cortices, the adrenal cortical steroids, and stress. The framework within which our investigations were to proceed has been defined. The next step was to define our technical methods, and this necessitated a review of the methods open to us for the assay of the adrenal cortical steroids. These we proceed to describe briefly.

METHODS FOR THE ASSAY OF ADRENAL CORTICAL STEROIDS.

The first method to give satisfactory results was that of Pfiffner, Swingle and Vars (1934), who determined the amount of substance or extract necessary to maintain the adrenalectomized dog permanently in a healthy state. In its time it was invaluable, but it was time-consuming, laborious, and required large quantities of the test substance. It would, of course, be quite unsuitable for our purpose where the total quantity available was minute. The immature rat, adrenalectomized, was also used in a similar type of test, and the smaller animal required less of the test substance, but the amount required still remained large.

Another method, introduced by Reinecke and Kendall (1942), was based on the discovery by Britton and Silvette (1932) that the adrenalectomized rat, when fasted, loses glycogen from the liver rapidly, and that if it is given adrenal cortical extract, the liver-glycogen is maintained or raised. This has proved to be an excellent method for assay, and has been used by us in this work. A number of modifications of the original method have improved both its accuracy and its sensitivity. A fuller discussion will be given with references later in the paper when we come to describe the details of our own method.

A third method of assay, introduced by Selye and Schenker (1938), is based on the facts that the adrenalectomized rat, if placed in severe cold (4°C.), succumbs more rapidly than the normal, and that adrenal cortical extracts can prolong its survival. It has been used by Dorfmann, Shipley, Schiller and Horwitt (1946), by Dorfmann, Horwitt and Shipley (1944), and by Venning, Hoffmann and Browne (1944), who demonstrated its reliability. But it needs large quantities of the test substance : to assay the cortins in urine, for instance, would require about 60 hours' excretion for each assay. This fact makes it unsuitable for our purpose.

The "water-intoxication" test, introduced by Kendall (1942), uses the facts that the adrenalectomized rat, if forcibly given water in large quantities, has difficulty in excreting it, and that adrenal cortical extracts will produce a subsequent diuresis. The method, however, is not very sensitive. Eversole, Gaunt and Kendall (1942) found that the use of as many as ten rats to a test will scarcely detect a doubling of the dose of 11-desoxy-corticosterone. And Schiller and Dorfmann (1943) found that about 10 l. of urine are required to give enough cortins for an assay. This again renders the method unsuitable for our purpose.

The "muscle-work" test was devised by Everse and de Fremery in 1932. Though enthusiastically promoted by Ingle, the method has found little favour, and has been used by few other workers. Little is known of its reliability or of its sensitivity.

For completeness we may mention some other biological methods of assay which have been attempted. There is the inhibition by adrenal cortical steroids of the hypoglycaemic action of insulin in the normal or adrenalectomized starving animal (Selye and Dosne, 1939; Grattan and Jensen, 1940; Grattan, Jensen and Ingle, 1941). There is the exacerbation by adrenal cortical steroids of an existing diabetes in the partially pancreatectomized animal (Long, Fry and Thompson, 1938; Ingle, 1940, 1941; Kendall, 1942). There is the production by adrenal cortical steroids of glycosuria in the normal animal (Ingle, 1941*a*, *b*; Ingle, Sheppard, Evans and Kuizenga, 1945). And there is the enhancement by adrenal cortical steroids in the phloridzinized animal of the glycosuria which has been lessened by adrenalectomy (Wells and Chapman, 1940).

Such are the methods used at times in the biological methods of assay. Some of them still hold their own because of their unique properties. But advancing knowledge of the steroids has enabled chemical methods, based on specific chemical configurations, to be devised. Such methods might be based on a variety of properties, but in practice most workers so far have used some method of extraction, followed by some application of the fact that a ketol side-chain at C-17 will act as a reducer. The number of steroids able to react in this manner is large and is not yet exactly known. Of the steroids already isolated from the adrenal cortex, those suitable chemically for this reduction are: corticosterone, 17-hydroxy-corticosterone, 11-dehydro-corticosterone, 17-hydroxy-11-dehydro-corticosterone, 11-desoxy-corticosterone, and those compounds known as Reichstein's C, D, N, P, R, S, and V. The first four of the compounds mentioned are known to be "sugar-active." On the other hand, the two properties, of causing chemical reduction and of causing glycogen-deposition, are not invariably associated. 11-desoxy-corticosterone, for instance, is known to be an active reducer of alkaline copper (Talbot, Saltzman, Wixom and Wolfe, 1945; Heard and Sobel, 1946), but is without effect in glycogen-deposition (Reinecke and Kendall, 1943; Olson, Thayer and Kopp, 1944). For this reason, if isolation of the pure compounds is not practicable, assays of adrenal cortical steroids or of urinary cortins should, so far as is possible, use a variety of methods, each assaying a variety of steroids.

The 17-ketosteroids need no discussion of their methods of assay, since these have been well known since the pioneer work of Callow, Callow and Emmens in 1939.

The possible methods for our assays have been outlined above. But when we came to consider their application, certain restrictions became apparent: a patient secretes in one day only a small quantity of steroid material, so that the assays cannot require more than this quantity; and it is also unfortunately true that most of the methods described are laborious and time-consuming, imposing, with limited staff, yet another restriction on the possibilities.

After consideration from all points of view it was decided to attempt triple assays on each patient: an assay of the 17-ketosteroids by the chemical method described, an assay of the "reducing" cortins by some chemical method which uses their reducing powers, and an assay of the "sugar-active" cortins by some development of the biological methods described above.

The methods for the assay of 17-ketosteroids are well known and need no preliminary study, but the methods for the assay of "reducing" and "sugar-active" cortins needed some study.

ASSAY OF ADRENAL CORTICAL STEROIDS.

The Effect of pH on Extraction.

The workers first in this field extracted urine unacidified for reasons which then seemed adequate (Venning, Hoffmann and Browne, 1944), but the importance of the pH at which the urine was extracted was later demonstrated by Venning, Kazmin and Bell (1946), who showed that treatment at pH 1 extracted about twice the cortins obtainable without acidification. In their experiment urine was first extracted by ethylene dichloride without acidification, and it yielded cortins equivalent to 98 μg. of 17-hydroxy-11-dehydro-corticosterone. It was then acidified to pH 1·0 and re-extracted: cortins equivalent to an additional 88 μg. were obtained. On allowing the same urine to stand overnight at room temperature still at pH 1·0 and extracting a third time, cortins equivalent to an additional 22 μg. were obtained. Daughaday, Jaffe and Williams (1948) have published a confirmation.

It is known that many of the steroids are excreted in conjugated form, often as glucuronides, and intensive hydrolysis may be necessary to hydrolyse them, this being particularly true of the keto-steroids. But the cortins responsible for glycogen-deposition and for copper reduction seem to be conjugated, if at all, in a form easily reversible. For it was shown by Heard, Sobel and Venning (1946) that if urine were acidified and then re-alkalinized before extraction, the yield was no more than from unacidified urine, though if extracted when first acidified a much larger yield could be obtained. It is clear, therefore, that hydrolysis of the glucuronides is not the reason for the success of acidification. More likely is it that the partition coefficient, being based on an equilibrium, is altered so as to drive more cortins into the aqueous phase. Here the results of Heard *et al.* seem decisive.

In order to achieve the highest possible sensitivity, we have studied the effects of extracting the urine at pH 1·0 and at pH 0 since the precisely optimal pH does not appear to have been located.

The pH was estimated by using methyl violet as indicator, the usual Cole-Onslow technique being followed. This indicator, otherwise excellent, has the disadvantage of being slightly unstable at these acidities, but this can be fully corrected by making the comparison between standard and unknown properly balanced so that the actions of the acids in the standard and in the urine proceed simultaneously. In this way any fading, which occurs only over about half an hour, affects both sides equally. In addition, as acid is added to the urine, a corresponding amount must be added to the urine which provides the colour balance, since at this pH a rapid formation of urobilin occurs from the urobilinogen present in the urine, causing a darkening of colour. The addition to both sides, however, ensures that any darkening shall occur equally. Using these improvements on the usual technique it was found easy to adjust the pH to within one-tenth of a unit. Most writers state, and our experience confirms, that hydrochloric and sulphuric acids are equally satisfactory. For uniformity we used hydrochloric throughout.

In order to determine the optimum pH of the extraction, and as it was known that pH 1·0 was better than less alkaline urine (Venning, Kazmin and Bell, 1946; Heard, Sobel and Venning, 1946; Daughaday, Jaffe and Williams, 1948), test extractions were made at pH 1·0 and at pH 0 since preliminary tests showed that a urine more acid than pH 0 became too heavily tarry. Several test were made under various conditions. The experiment below was typical.

A pooled sample of urine was adjusted to the pH required, extracted with one-tenth of its volume of chloroform immediately, and then extracted twice more. The extracts were combined, washed repeatedly with N/10 sodium hydroxide, washed three times with water and evaporated *in vacuo* at a temperature of 50° C. Cortins from 17⅓ days' total urine were dissolved in ethanol and administered to 12 rats intraperitoneally with glucose, following the methods to be described later. The results are shown in Table I:

TABLE I.—*Change of Liver-Glycogen of Adrenalectomized Rat for Cortins Extracted at pH 1 and pH 0.*

No. of rats.	pH of extraction.	Days' urine.	Glycogen deposited (mgm./100 gm. rat).				Average.
4	1·0	⅓	69,	38,	32,	73	53
4	1·0	1	93,	60,	144,	82	95
4	1·0	3	128,	132,	189,	165	153
4	0·0	⅓	27,	13,	21,*	23	21
4	0·0	1	45,	20,	16,	47	32
4	0·0	3	39,	38,	86,	32	49

* Rat died.

The results are shown in Fig. 2.

The improvement in sensitivity and slope of the material extracted at pH 1·0 over that extracted at pH 0·0 is obvious. The statistical analysis and test of significance (using the method of Mather (1943)) is given in Table II. The differences between the regressions, i.e., the slopes, and the means are statistically significant.

Stability of the Extracted Cortins.

The processes of extraction must not destroy even partially the cortins they are attempting to isolate, and knowledge of the stabilities of cortins under various treatments is of prime importance. We have given these matters some careful attention.

Most workers have used anaerobic conditions for some stages in the processes for the extraction of cortins, and have usually evaporated *in vacuo* at temperatures not exceeding 50° or 55° C. This is surprising since Kendall showed, as early as 1942, that his extracts were affected neither by heating to 80° C. for one hour, nor by boiling in benzene (B.P. 80·2° C.) for one hour, nor by vigorous aeration at room temperature for thirty minutes at pH 7·4. Thayer (1946), too, found no change in his assay standards if kept at 4° C., even after eighteen months.

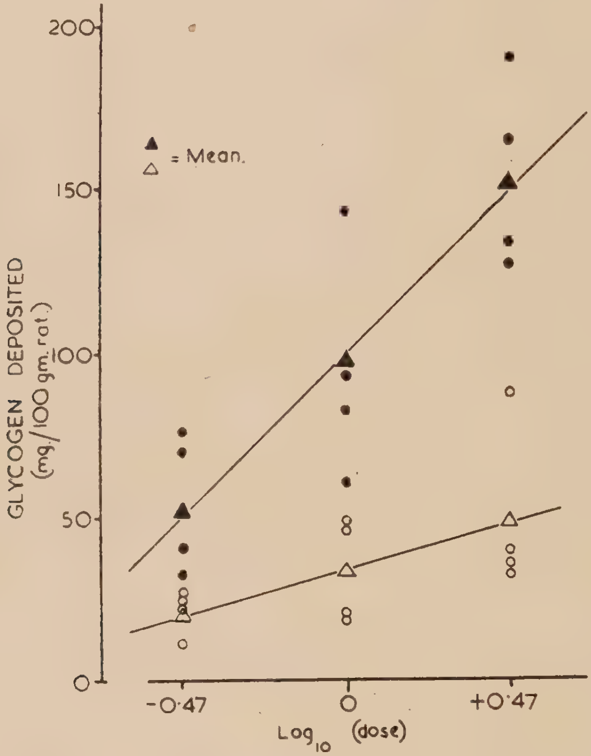

Fig. 2.—Responses of liver-glycogen in the adrenalectomized rat to three dose-levels of cortins extracted at the pH's of 1·0 (solid circles) and 0·0 (open circles).

Table II.—*Analysis of Variance of Responses to Cortins.*

Variance.	DF.	Sum sq.	Mean sq.	Var. ratio.	P.	Sigce.
Common regression	1	16448·063	16448	30·9	<0·001	**
Between regressions	1	5292·563	5293	10·0	0·004	**
Between means	1	26533·500	26534	49·9	<0·001	**
Residual	20	10617·207	531	..	..	..
Total	23	58891·333	..	..	..	..

(We shall use throughout the convenient symbolism that

** = significant at the 1 per cent. level,
* = significant at the 5 per cent. level,
0 = not significant.)

In order to be sure that our proposed method was not causing a loss of cortins, we investigated the effects of air and temperature in several ways in order to establish that our own methods were adequate in these respects.

Urine was extracted at pH 1·0 with chloroform and the extract washed with N/10 sodium hydroxide, and water, and evaporated down *in vacuo* at a temperature of 50° C. to about 15 ml., so as to yield a batch of cortins prepared under standard conditions. Sixteen portions of 1 ml. each were transferred to sixteen test-tubes, and were dried at 50° C. under a stream of nitrogen. With the tubes still open to the air they were placed in the refrigerator at 4° C., and were allowed to remain there for varying lengths of time. Finally their power to reduce alkaline ferricyanide was tested, any deficiency being due to previous oxidation. Table III shows the averages of duplicate tests, expressed as mg. of glucose equivalent in reducing power to the cortins after the treatments described:

TABLE III.—*Effect of Treatments on Reducing-Cortins.*

Treatment.	mgm. glucose equivalent.
Tested immediately as control	0·22
Kept in refrigerator 48 hours and then at room temperature for 24 hours	0·29
Kept in refrigerator for 3 days	0·32
,, ,, 4 ,,	0·32
,, ,, 5 ,,	0·33
,, ,, 6 ,,	0·31
Kept in refrigerator for 6 days, then dissolved in chloroform and re-evaporated in N_2	0·31
Kept in refrigerator for 14 days, then dissolved in chloroform and re-evaporated in N_2	0·29

The results show that, instead of decreasing, the reducing powers slowly increase, probably, as shown above, because of the elimination of tarry bodies which are interfering with full solution of the steroids. It will also be noticed that the evaporation under a stream of nitrogen caused no loss of reducing power. This evidence, therefore, suggests that loss by oxidation is not to be feared.

In order to gain more assurance on this point, the experiment was extended to include a more drastic test. A second batch of urinary extract of cortins was purified, well mixed, and was distributed equally over sixteen tubes. Eight of these solutions of cortins were dried under a stream of nitrogen at 50° C. and were sealed hermetically in this gas, while the other eight were dried, also at 50° C., but under a stream of pure oxygen, and were then left open to the air. All were then stored in the refrigerator at 4° C. After 0, 3, 7, and 20 days in the refrigerator, pairs of tubes were tested against alkaline ferricyanide for their reducing power. The results, expressed in mgm. of equivalent glucose, are given in Table IV:

TABLE IV.—*Reducing Powers of Cortins Stored Under Nitrogen and Under Oxygen.*

		Stored in—	
		N_2.	O_2.
Days stored at 4° C.	0	0·31	0·42
		0·38	0·39
	3	0·49	0·43
		0·41	0·40
	7	0·48	0·50
		0·45	0·50
	20	0·38	0·39
		0·38	0·42

The changes are shown in Fig. 3.

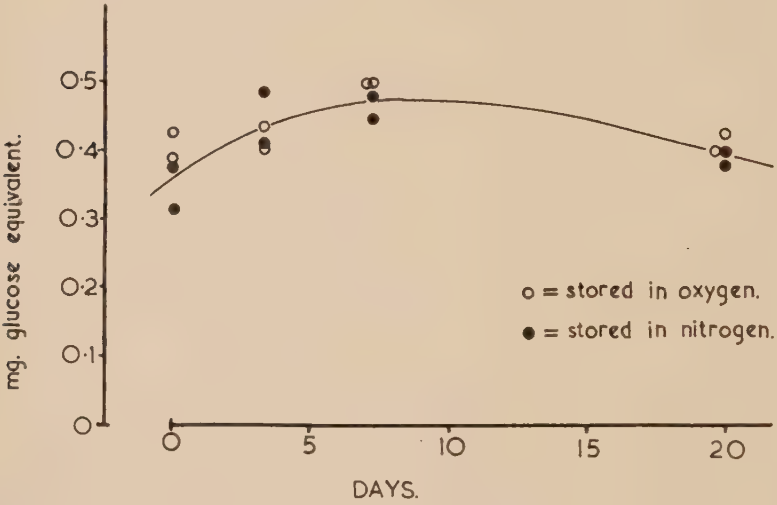

FIG. 3.—Reducing powers of cortins stored under nitrogen (solid circles) and oxygen (open circles) for varying lengths of time.

Which gas is used for drying seems to make no difference; but there is a tendency for the value to rise to a maximum at about the seventh day and then to fall. The statistical significance of these changes is decided by the analysis of variance shown in Table V.

The analysis shows decisively that a significant change occurs with time, and it also shows that so far as can be detected by this experiment the two gases do not differ in their effect. The change with time is again probably due to the oxidation of tarry substances allowing a more effective solution of the steroids.

TABLE V.—*Analysis of Variance of the Results of Table* IV.

Variance.	DF.	Sum sq.	Mean sq.	Var. ratio.	P.	Sigce.
Between days (D)	3	268·25	89·5	9·55	<0·01	**
„ gases (G)	1	16·00	16·0	1·71	>0·2	0
Interaction (DG)	3	48·50	16·1	1·72	>0·2	0
Residual	8	75·00	9·37	..	..	..
Total	15	407·75	..	..	..	..

As the reducing power tends to a maximum, i.e., to a level, at about one week after preparation, all our analyses have been conducted at about this time since in this way any error is minimized.

It is concluded therefore that oxidation is not seriously to be feared, that temperatures of 50° C. are harmless to our cortins, and that storage at 4° C. changes them little. There is, therefore, evidence that our processes of assay will not be appreciably in error from these factors.

Collection of Material.

A difficulty encountered early in the investigation is that, being based on a 24-hour specimen, the cortin assay will be falsified if the urinary collection is incomplete. In the majority of the cases in our series the patient was co-operative and reliable. But if the patient was ambulant and not under continuous observation, and if the convulsive treatment made the patient forgetful, then the collection might be incomplete, and the institution of a more positive check seemed desirable.

Such a check is provided by first estimating the amount of creatinine excreted in each 24-hour specimen, and then, if necessary, expressing the results of other assays by their relation to the quantity of creatinine excreted. Heard, Sobel and Venning (1946), for instance, used this method and demonstrated its value. Throughout this investigation, therefore, creatinine was estimated in all specimens as a precaution against loss. It was estimated in the usual way by forming its picrate, by reading the extinction coefficient of the solution in the photo-electric colorimeter with an Ilford 302 filter, and then by converting the extinction coefficient to the concentration of creatinine with the aid of a previously established graph.

Before this correction can be applied, however, it is necessary to establish that convulsive therapy does not itself alter the excretion of creatinine. Although the effect of prolonged muscular activity on creatinine metabolism is well known, yet there is little evidence to suggest that a single convulsion causes an appreciable change in the amount excreted over 24 hours. In order to test this, our own results were searched for evidence of such change, but no evidence was found. We may, for instance, quote as typical the results obtained from two patients (H— and B—), who were fully co-operative in the collection of urine and who were, moreover, in bed and under continuous observation throughout the treatment. In these two cases, therefore, we can be sure that the results are not vitiated by an incomplete collection of the urine. Table VI shows their excretions of creatinine (as gm./24 hours) in those 24 hours in which convulsions were administered (marked "+"), and also in those 24 hours in which they were not administered (marked "−").

TABLE VI.—*Effect of Convulsions on Creatinine Excretion.*

Patient.			
H—.		B—.	
+	−	+	−
1·58	1·65	1·57	1·09
1·77	1·55	1·33	1·38
1·95	1·53	0·78	1·28
1·35	2·00	2·26	1·10
2·04	1·54	1·09	1·72
0·93	1·64	0·64	1·35
1·28	2·00	1·34	1·39
1·45	1·93	1·68	0·93
2·00	1·39	1·44	1·54

The mean excretions of creatinine are:

On days with convulsions (+): 1·47 gm./24 hours.
On days without convulsions (−): 1·50 gm./24 hours.

The difference is small and is statistically insignificant ($t = 1{\cdot}27$, $n = 34$, and $P = 0{\cdot}20$).

There is therefore no evidence that convulsive treatment is causing serious disturbance to the 24-hour excretion of creatinine. It may therefore properly be used as a check on the completeness of the collection of the urine.

Method of Chemical Estimation.

For the final reduction a variety of methods has been used. Talbot, Saltzman, Wixom and Wolfe (1945), Heard and Sobel (1946), and Heard, Sobel and Venning (1946) reduced alkaline copper, and then measured in the photoelectric colorimeter the blue colour produced by the reduction of arsenomolybdate. Daughaday, Jaffe and Williams (1948) have developed a method by which periodic acid reacts with the ketol side-chain at C-17 to liberate formaldehyde, using the reaction of Lowenstein and Zwemer (1943), which then develops with chromotropic acid a colour suitable for measurement in the colorimeter. Hemphill and Reiss (1947) used the method of Hagedorn and Jensen (1923). We, too have found the latter method excellent. Provided that the cortins are carefully freed from tarry matters, it gives accurate and reproducible results.

We therefore selected the following method, which will be described definitively:

The urine is collected in 24-hour batches; 5 ml. of chloroform is added initially if the weather is warm. The creatinine content is measured on all batches as a check on the completeness of collection. The urine is acidified to pH 1·0 with hydrochloric acid, and is extracted three times with one-tenth of its volume of chloroform. The chloroform is separated, and any emulsions which have formed are broken down by centrifuging and by treatment with anhydrous sodium sulphate. By heating *in vacuo* at a temperature thermostatically controlled at 50° C., the chloroform is evaporated down to about 10 ml. This is now washed repeatedly with 5 ml. lots of N/10 sodium hydroxide until no trace of phenolic substances can be extracted. After this it is washed three times with 5 ml. of water, and the washings back-extracted with 10 ml. of fresh chloroform which is added to the main solvent. This is again reduced in volume by evaporating *in vacuo* at 50° C. to a few ml., which are transferred to an open tube. Washings ensure that the transference is complete, and the chloroform is driven off at 50° C. under a stream of nitrogen. The dried cortins are kept for one week at 4° C. They are then dissolved in 1 ml. of absolute ethanol, of which 0·5 ml. is added to 10 ml. of water to which has been added 2·0 ml. of Hagedorn-Jensen's alkaline ferricyanide. After heating it in a boiling water bath for 15 minutes iodide and acid are added, and the liberated iodine is titrated with N/200 sodium thiosulphate in the usual manner. The calculation is straightforward, the weight of cortins being expressed as the weight of glucose which is equivalent in reducing power. This simple, direct way of stating the facts seems to be preferable to the use of a single conversion factor since, as the cortins are a mixed group of substances of varying reducing powers and of varying molecular weights, no single conversion factor can be adequate.

Having completed the survey of the assay of cortins by chemical methods, we now turn to the methods based on the fact that the adrenalectomized rat, if starved, loses quickly the glycogen from its liver, and even if given carbohydrates, has difficulty in forming new glycogen. The administration of certain "sugar-active" adrenal cortical steroids, however, results in a rapid increase of the glycogen content of the liver, and this has been used as the basis for a method of assay.

But such a method of assay requires study in many details if it is to be accurate and reliable. We shall, therefore, proceed to study some of the factors which need a preliminary investigation.

The Effect of Age of Rat.

For our purpose it was of the highest importance that our method should be sensitive, the reason being that the quantity of cortins excreted in a day by a patient is small, and the amount of experiment that can be conducted on it correspondingly limited. And if it is intended to estimate that quantity by animal assay, then the number of replicates, on which the accuracy depends, is similarly limited. Conversely, if a new method could be developed, more sensitive so that the same amount of cortins could provide material for an assay using a larger number of animals, then the accuracy of the assay would, other things being equal, be proportionately increased.

The Reinecke-Kendall (1942) assay had originally used adult rats. Venning, Kazmin and Bell (1946) had improved the sensitivity by using mice, but this had introduced various minor disadvantages, one of which is that the white rat as experimental animal is usually much superior to the mouse in its reliability and in providing reproducible results. For this reason the possibility of using the young, immature white rat was explored.

Few workers have tested this animal for this purpose. Olson, Jacobs, Richert, Thayer, Kopp and Wade (1944) used a few immature rats, but being uninterested in the question of sensitivity, they developed the possibilities no further. Their data, however, show clearly that the performance of the immature rat was at least as satisfactory as that of the adult.

In order to investigate the possibilities we conducted a variety of experiments, of which those given below are typical.

(1) Eight mature and eight immature adrenalectomized rats were injected with a standard preparation of adrenal cortical steroids (Eschatin), at two doses together with their appropriate primings of glucose, using the technique described below, in order to find both the size of dose needed to provoke an optimal deposition of glycogen, and also to find the change in the amount of glycogen deposited when the dose of steroids was changed in some standard way, in this case, doubled. The results are given in Table VII :

TABLE VII.—*Changes of Liver-Glycogen Induced by Adrenal Cortical Extract in Mature and in Immature Adrenalectomized Rats.*

No. of rats.	Age.	Dose of Eschatin (ml.).	Glucose given (gm.).	Glycogen deposited (mgm./100 gm. rat).	Mean.	Response to doubled dose.
4	Mature	1·8	0·42	5, 37, 14, 25	20·0	17·0
4	,,	3·6	0·60	57, 53, 10, 28	37·0	
4	Immature	1·8	0·21	103, 77, 70, 54	75·9	49·4
4	,,	3·6	0·21	181, 118, 136, 66	125·3	

The increased sensitivity of the immature rats is shown clearly. Not only do they give a much heavier average response than the mature rats (in ratio 1 : 3·4) but the steepness of response to the doubled dose is increased from 17·0 to 49·4. This increase in the steepness of response is highly favourable to the accuracy of the assay, for since the accuracy of assay (the "invariance") varies as the square of the slope, the improvement is as 1 to $(49/17)^2$, i.e., approximately as 1 to 8.

The doubling of the dose in the immature rats has increased the glycogen deposition on the average by about 49 mgm. (per 100 gm. animal). This may be compared with the mouse method of Venning *et al.* (above), which, for a doubled dose, increases by 29 mgm. (per 100 gm. animal). Our rat method is therefore not defective in sensitivity when compared with theirs.

(2) In order to test the reliability of the base line when no cortin is given, nine immature were compared with nine mature rats when only saline was injected, all being adrenalectomized. The results are shown in Table VIII :

Table VIII.—*Basic Glycogen Contents of Livers of Mature and Immature Adrenalectomized Rats.*

No. of rats.	Age.	Glycogen deposited (mgm./100 gm. rat).	Mean.	S.D.
9	Mature	4, 4, 12, 4, 20, 3, 5, 43, 4	11·0	±13·2
9	Immature	4, 8, 4, 6, 4, 17, 7, 4, 8	6·9	±13·1

The means and the standard deviations show that the immature rats compare not unfavourably with the mature in the regularity with which they show the appropriate low values.

(3) In another series of tests, immature adrenalectomized rats were given adrenal cortical steroids (Eschatin) at doses of 0·25 to 2·00 ml. in order to explore their response to the larger doses. The results are given in Table IX:

Table IX.—*Glycogen Deposited at Various Dose-Levels of Adrenal Cortical Steroids in the Immature Adrenalectomized Rat.*

No. of rats.	Dose of Eschatin (ml.).	Log (dose).	Glycogen deposited (mgm./100 gm. rat).	Mean.	S.D. (mean).
8	0·25	−0·602	79, 55, 46, 53, 60, 73, 66, 51	60	± 4·0
8	0·50	−0·301	63, 138, 104, 44, 13, 100, 178, 254	112	±27·4
8	1·00	0	102, 45, 58, 141, 135, 79, 79, 144	98	±13·7
8	2·00	+0·301	133, 75, 86, 128, 170, 82, 145, 114	116	±11·9

The results show that in this batch the response flattens out after reaching a level of about 110 mgm./100 gm. rat.

(4) The responses of the immature rat when tested with urinary cortins are similar. Thus, twelve immature adrenalectomized rats were injected with extracts from a pooled urine so that the doses corresponded to extracts from $\frac{1}{3}$, 1 or 3 days' urine, thus testing the responses to treblings of the doses. The results are given in Table X:

Table X.—*Glycogen Deposited at Various Dose-Levels of Urinary Cortins.*

No. of rats.	Dose (extract from days' urine).	Glycogen deposited (mgm./100 gm. rat).	Mean.	S.D. (mean).
4	$\frac{1}{3}$	69, 38, 32, 73	53·0	±10·5
4	1	93, 60, 144, 82	94·8	±17·8
4	3	128, 132, 189, 165	153·2	±14·4

The results are graphed in Fig. 4, which shows the curve relating the response of the glycogen deposited to the logarithm of the dose.

The line drawn has been fitted by the method of Least Squares. In this batch the rats have responded to the highest dose with a glycogen deposition of 153 mgm./100 gm. rat and the regression line has been extended to that level.

The equation of the regression line is

$$Y = 105{\cdot}031\ D + 100{\cdot}333$$

where D is the logarithm (to base 10) of the dose given. A doubling of the dose will therefore raise the glycogen deposition by 0·301 × 105, i.e., by

32 mgm./100 gm. rat. This value is lower than that of the first experiment described above, but these variations are inevitable in animal assay methods. Both values, however, compare satisfactorily with Venning's value of 29.

Use of the immature white rat (weighing 35–50 gm.) gives, therefore, a substantial increase in sensitivity over the use of the mature rat (weighing 150–200 gm.).

The Effect of Insulin on the Assay.

In searching for a means of improving the sensitivity of the assay, an attempt was made to increase the amount of glycogen deposited by the use of insulin, and experiments were performed in order to explore this possibility.

In a first experiment, factorial in design, insulin at doses of 0, 0·1 and 0·5 units was combined with adrenal cortical steroids (Eschatin) at doses of 0, 0·25 and 0·5 ml., each of the nine combinations being tested in duplicate. The results are given in Table XI, which shows the glycogen deposited:

TABLE XI.—*Glycogen Deposited with Combinations of Insulin and Adrenal Cortical Steroids.*

		Insulin (units).		
		0	0·1	0·5
Eschatin (ml.)	0	45 37	44 21	40 18
	0·25	119 104	69 72	71 45
	0·5	7 116	106 32	35 101
	Mean . .	71	57	52

Inspection of the means at the foot of the columns shows that the glycogen deposition is, if anything, lessened by insulin. Table XII shows the analysis of variance of these results:

TABLE XII.—*Analysis of Variance of the Results of Table* XI.

Variance.	DF.	Sum sq.	Mean sq.	Sig$^{\text{ce}}$.
Eschatin doses	2	6632·1	3316	0
Insulin doses	2	1229·8	615	0
Interaction	4	2121·9	531	0
Residual	9	11850·0	1317	. .
Total	17	218·338	. .	. .

The last column shows that the effect is not significant. It seems, therefore, that insulin does not increase the sensitivity.

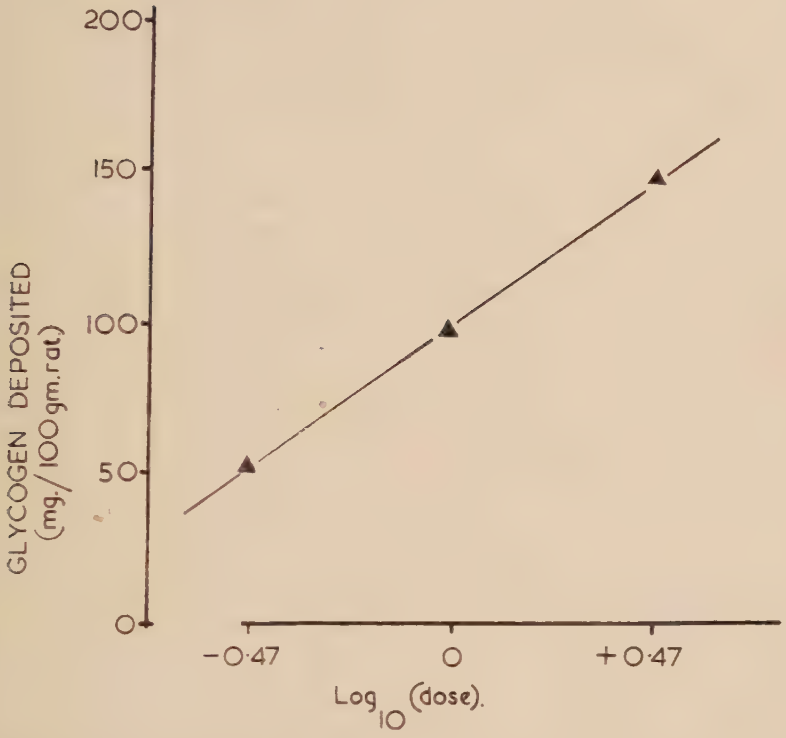

FIG. 4.—Logarithmic dose-response curve of the immature adrenalectomized rat to cortins. Each triangle represents the mean of four animals. The regression line $Y = 105 \cdot 0\ D + 100 \cdot 3$ has been added.

The Effect of Extra Glucose.

A fundamental improvement in the methods for the assay of the "sugar-active" cortins was made by Venning, Kazmin and Bell (1946) when they found in the adrenalectomized rat that if the liver glycogen were to be raised above its basic value by the administration of glucose, then the quantity of glucose given must exceed a "threshold." Further, they showed that if such a rat were given glucose at a dose adjusted in size to be just below the threshold, then the liver would respond with the deposition of glycogen to a dose of cortins much smaller than if no glucose were given. Further, the responses were more regular, between rat and rat, than without such "priming" glucose. By the use of this improvement, these workers were able to achieve an altogether new level of accuracy and sensitivity in the assay of the "sugar-active" cortins.

But since they found that different strains varied much in their glucose requirements, and as we wished to explore the possible use of immature animals not tested by them, it seemed safer for us to establish our own standards, and this we proceeded to do.

The priming glucose may be administered by various routes. As the injection of large quantities of glucose solution into the peritoneal cavity is a method well known to cause dehydration and shock (Long, 1942; Reiss, MacLeod and Golla, 1943), we tried the suitability of administering the necessary glucose by stomach-tube. Eighteen adrenalectomized male mature fasted rats were therefore given glucose in solution at six dose-levels by this route, the whole glucose being divided into seven doses. At the end of the treatment the livers were removed and assayed for glycogen in the manner described below. The results are given in Table XIII :

TABLE XIII.—*Glycogen Deposited after Administration of Varying Doses of Glucose by Stomach-tube.*

No. of rats.	Dose of glucose.	Log (dose).	Glycogen deposited (mgm./100 gm. rat).	Mean.	S.D. (mean).
3	0·105	—0·979	46, 48, 22	39	8
3	0·21	—0·678	38, 18, 61	39	12
3	0·42	—0·377	37, 58, 100	65	18
3	0·84	—0·076	60, 96, 59	72	12
3	1·68	+0·225	51, 75, 68	65	7
3	3·36	+0·526	111, 111, 70	97	10

Evidently, within this dose-range, absorption by this route does not result in a clear threshold.

As this was considered unsatisfactory, smaller doses of glucose being considered not sufficient to act as adequate priming, further exploration was made of the intraperitoneal route. If shock can be avoided, this route of administration has definite advantages : there is the fact that the area of absorption is larger than that available in subcutaneous or intramuscular injection, resulting in a proportionally more rapid rate of absorption ; there is the fact that the lining membrane is more vascular than that of the subcutaneous spaces, again resulting in a more rapid rate of absorption ; and there is the fact that the route of absorption leads, through the portal vein, directly to the liver and not to the systemic organs.

Shock is by no means a necessary sequel to intraperitoneal injection, and Remington (1940) has shown that glucose solution causes no symptoms if it does not exceed 10 ml. of 5 per cent. solution per 100 gm. of body weight.

To find the dose of glucose required for priming our strain of rats when given intraperitoneally, we injected ten mature adrenalectomized male fasted rats intraperitoneally with glucose, the total dose being divided into seven parts, and injected at intervals of 45 minutes in order to allow steady absorption.

The results are shown in Fig. 5.

The new method shows a satisfactory separation between the insufficient and the sufficient doses of glucose, the threshold lying at about 0·4 gm.

The same test was also applied to the immature rats. Twenty-five males and twenty females, adrenalectomized and fasted, were treated similarly except that the doses were reduced to a level proportionately lower. As the solutions in the assays would contain 10 per cent. ethanol, this was included.

The averages are shown in Fig. 6.

It shows clearly that a threshold for glycogen deposition in the liver occurs at a dose of about 0·2 gm. when given under these conditions.

These experiments demonstrate that a dose of about 4·0 mgm. of glucose per gm. of rat, administered intraperitoneally, provides a suitable priming for our strain of rats, and this dose has been confirmed by our subsequent assays. It has therefore been used throughout.

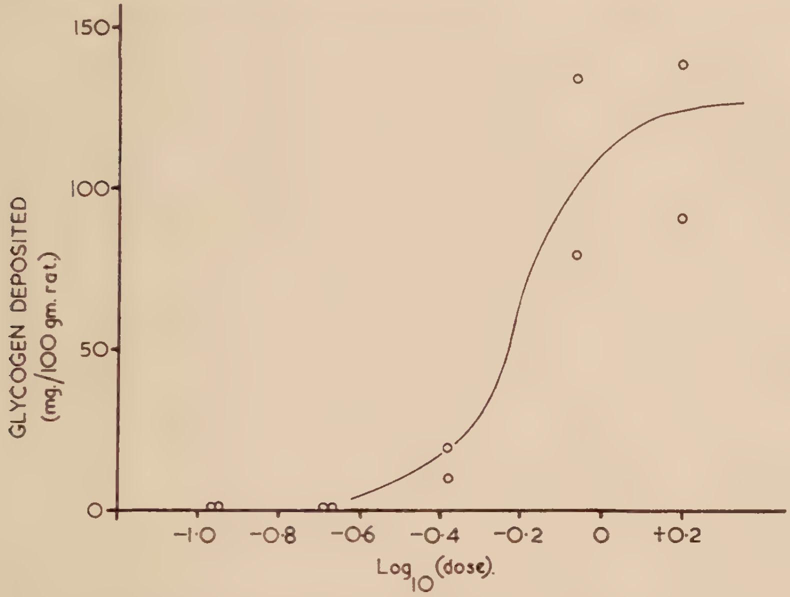

Fig. 5.—Quantities of glycogen deposited in the mature adrenalectomized rat as the quantity of glucose is increased. The threshold at − 0·2 is clearly shown.

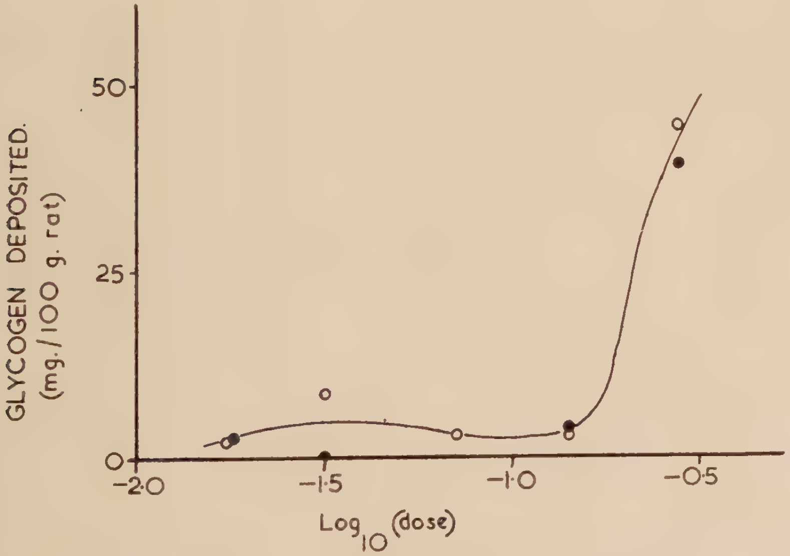

Fig. 6.—Quantities of glycogen deposited in the immature adrenalectomized rat as the quantity of glucose is increased. Males = solid circles, females = open circles. The threshold is shown clearly.

Administration of Cortins.

A variety of routes has been used by previous workers, especially before it was known which was the best.

Dorfmann, Horwitt and Shipley (1944), investigating the properties of pure crystallized steroids, administered them by stomach-tube, but no other workers have followed this method, all others, so far as we are aware, having given them by injection, either subcutaneously, intramuscularly, or intraperitoneally. For the injection various solvents have been used ; solution in oil was used by many, until Venning and Browne (1947) demonstrated clearly the superiority of 10 per cent. ethanol as solvent.

Although injection intraperitoneally posesses certain advantages, yet this route has been used only by a minority of workers, the majority having used the easier subcutaneous route. As little information is available about the rate of absorption of cortins through the peritoneum, we proceeded to discover this rate by observing the amount of glycogen deposited at increasing times after an initial injection of adrenal cortical steroids.

Eschatin was again used as the standard preparation. As the experiment required that the steroids and the priming glucose be given in one dose, and as the introduction of all the glucose into the peritoneal cavity in a single injection would cause shock (as mentioned above), we gave the steroids intraperitoneally and the glucose by stomach-tube. As we were testing purely for a comparative effect, the difficulty mentioned earlier does not arise.

Twelve rats, adrenalectomized, immature and fasting, were given, at zero hour, an intraperitoneal injection of 0·2 ml. of Eschatin and, by stomach-tube, 1·5 ml. of 10 per cent. glucose in water. Immediately, i.e., at zero hour, and subsequently at hourly intervals, a pair of rats was killed and their livers assayed for glycogen in order to ascertain how the deposition of glycogen was progressing.

The results are shown in Fig. 7.

The results are unambiguous. The amount of glycogen deposited rises to a maximum at 3 hours after the injection and then declines. From this we may deduce that, as glycogen cannot be deposited until the steroids have been absorbed, the major part of the steroids must have been absorbed prior to the peak at 3 hours. Further, there can have been little steroid absorbed after this time, for the glycogen content falls steeply, instead of being maintained at its 3-hourly level, as would happen if further portions of the injected steroids continued to arrive at the liver. It seems reasonable to deduce, therefore, that almost all the injected steroids have reached the liver and have exerted their action in less than 3 hours.

In our assays the cortins were injected in seven doses given at $\frac{3}{4}$-hour intervals, so that the total quantity was spread over $4\frac{1}{2}$ hours. As the animals were killed one hour after the last dose, it follows that four of the seven doses had exerted their full effect, and that only one dose, the last, is allowed less than $1\frac{1}{2}$ hours in which to act. Adequate effect has probably been achieved. Complete effect is, of course, not essential, since the assays are based on a

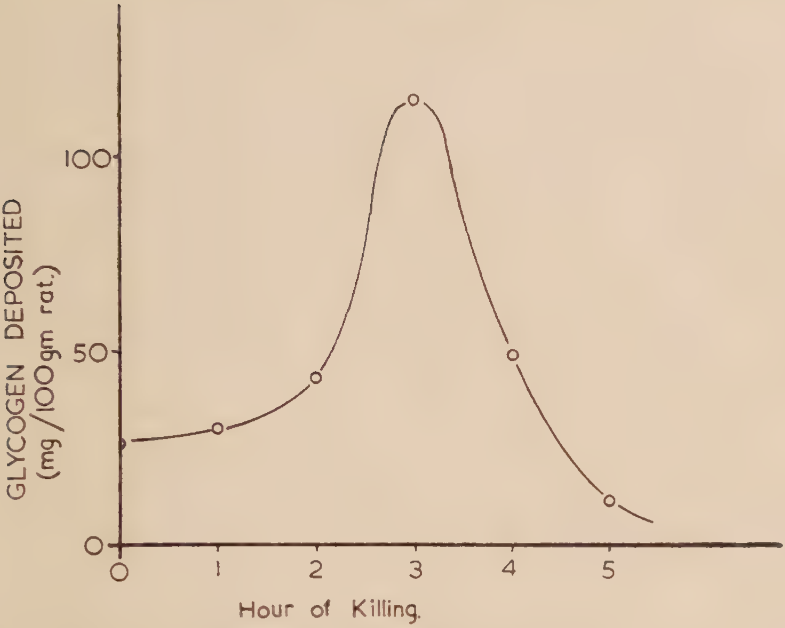

FIG. 7.—Changes in liver-glycogen in the adrenalectomized immature rat after the administration, at zero hour, of adrenal cortical steroids. The maximum at 3 hours is clearly demonstrated.

comparison, which requires only that the test and the control be exactly balanced.)

For these reasons, and guided by our experience, we selected the following method as optimal for the administration of our cortins: After storage for one week, in accordance with the results of the earlier experiments, the dried cortins were dissolved in an appropriate volume of absolute ethanol; the calculation is given below. An aqueous solution of glucose was then added so that the final solution contained 10 per cent. of ethanol, was of volume sufficient to provide seven doses of 0·4 ml. each, and contained a total of 0·15 gm. of glucose, which was the usual priming dose.

The calculations required are straightforward. The seven injections make a total volume of 2·8 ml. As this is to contain 10 per cent. ethanol, 0·28 ml. of ethanol are used to dissolve the cortins. Next, as the final solution must contain 0·15 gm. of glucose, we can add, say, 2·0 ml. of 7·5 per cent. glucose, followed by 0·52 ml. of water to complete the volume. Saline was not used as solvent, for the solution, containing 10 per cent. ethanol and 5·35 per cent. glucose, is already hypertonic in relation to the tissues.

This method of dissolving the cortins resulted in a solution which was clear or only slightly opalescent. Given intraperitoneally and warm, it was usually tolerated well, symptoms of shock being transient and rare.

The Estimation of Liver Glycogen.

The method of killing the rat is of some importance since shock, excitement, and the metabolic disturbances of the agonal state should all be avoided. We suspected at first that there might be a serious loss of glycogen occurring in the interval between the killing and the destruction by heat and potash of the glycolytic enzymes of the liver. Glycogenolysis is known to proceed more slowly in the adrenalectomized rat (Eggleston, Johnston and Dobriner, 1946), but we preferred to obtain quantitative data about this possible source of error. As a preliminary test we deliberately introduced delays in order to measure their effects.

An adult male rat, of weight 172 gm., was killed instantaneously by neck-break, and the liver excised and minced as rapidly as possible. (The necessity for the mincing is shown below.) After delays of known duration, weighed samples of the minced liver were transferred to boiling 30 per cent. potassium hydroxide and assayed by the method described below. Table XIV shows the results of the delays:

TABLE XIV.—*Glycogen Contents of Liver at Times After Death.*

Time of delay (minutes).	Glycogen content (gm./100 gm. liver).
2	1·84
3	1·82
4	1·63
11	1·54

The glycogen content will be seen to be progressively falling, so that variations in the time of delay will be apt to introduce variations in the glycogen content.

The sudden kill by neck-break was therefore replaced by the gentler method of anaesthetizing by the injection of sodium amytal. Animals falling under its influence showed neither fear nor excitement, but usually proceeded after a few minutes to go through their habitual routine prior to sleeping

As sodium amytal was used as anaesthetic, was given intraperitoneally, and would thus be absorbed partly through the portal system and liver, the possibility arose that this substance might react or interfere chemically with the processes of the assay. These processes were therefore studied at each stage, with a known quantity of sodium amytal added, but at no stage was there found any evidence of interaction.

For the estimation of liver glycogen, the method of Good, Kramer and Somogyi (1933) has, in our hands, proved reliable and accurate.

17-KETOSTEROID ASSAY.

The total 17-ketosteroid excretion was measured in our series of cases in order to provide further information on the metabolism of the adrenal cortical steroids, and especially of their end-products.

The method used is based on that of Callow, Callow and Emmens (1939) and is as follows:

From the 24-hour specimen of urine is taken 250 ml., and to this is added 25 ml. of concentrated hydrochloric acid. The mixture is raised rapidly to the boiling point and is maintained there for 10 minutes. It is cooled slightly, 75 ml. of carbon tetrachloride are added, and the mixture is boiled under a reflux condenser for 20 minutes. It is then cooled, and the carbon tetrachloride separated. This is washed once with distilled water, once with 10 per cent. sodium hydroxide and twice again with water. The carbon tetrachloride is driven off by evaporation *in vacuo*, the residue taken up in 4 ml. of absolute ethanol, and the solution filtered.

Every few days potassium hydroxide of A.R. grade is dissolved in absolute ethanol, filtered in the dark, titrated and adjusted to 2·5 N., and kept in a stoppered bottle out of the light at 4° C.

Into two tubes are placed 0·2 ml. of the solution of ketosteroids and 0·2 ml. of absolute ethanol as "blank." To each is added 0·2 ml. of a 2 per cent. solution of dinitrobenzene (A.R.) in ethanol and 0·2 ml. of the 2·5 N. alcoholic potash. After mixing, the tubes are stoppered and placed in a water bath at 25° C. for one hour in the dark. Then to each is added 10 ml. of absolute ethanol and their extinction coefficients read directly, either in the Zeiss-Pulfrich photometer or in the photo-electric colorimeter using a green-yellow filter. Previous calibration with pure androsterone had determined the relations between extinction and concentration, and this relation is used to determine the weight of 17-ketosteroids in the sample.

The survey of the methods available for assaying the sugar-active, the reducing cortins, and the 17-ketosteroids, is now completed; three methods have been examined in some detail, and have been defined in their necessities for accurate and reliable results. We now proceed to the application of these methods to our clinical material.

Cortin Excretion in the Hours Following a Convulsion.

Before the work could be planned one fact had to be discovered: whether the changes in cortin excretion, if any, occurred over minutes, over hours, or over days. The question was of some importance, for a method adequate for the demonstration of changes occurring at one rate or duration might be inadequate to reveal changes occurring at other rates or durations.

To anticipate, we have found that changes in the excretions of cortins occur chiefly over days rather than over hours; so we shall first present the evidence, negative in character, which suggests that a single convulsion causes no appreciable change in cortin excretion in the succeeding few hours.

The assay by adrenalectomized rat needs an amount of cortin obtainable only from about 24 hours' urine, so the method is not able to show any change of a duration less than this. But the chemical method of assay can determine much smaller quantities of cortins, and has been used by us to ascertain the effect of the fit on cortin excretion during the few hours which follow.

Using this method, we have measured the excretion of reducing cortins at two-hourly intervals throughout the day, i.e., from 8 a.m. to 8 p.m., the convulsion being given at 10 a.m. Further, in order to allow for the possibility of any diurnal trend apart from the convulsion, the results were compared with those found similarly but on days on which no convulsion had been administered. In order to eliminate possible slow temporal changes, the days on which convulsions were given alternated with the control days.

Each two-hourly specimen was collected with care as to its completeness and accuracy of timing. Each was extracted separately, using the methods described above, and the cortins were determined chemically.

The results are shown in Fig. 8.

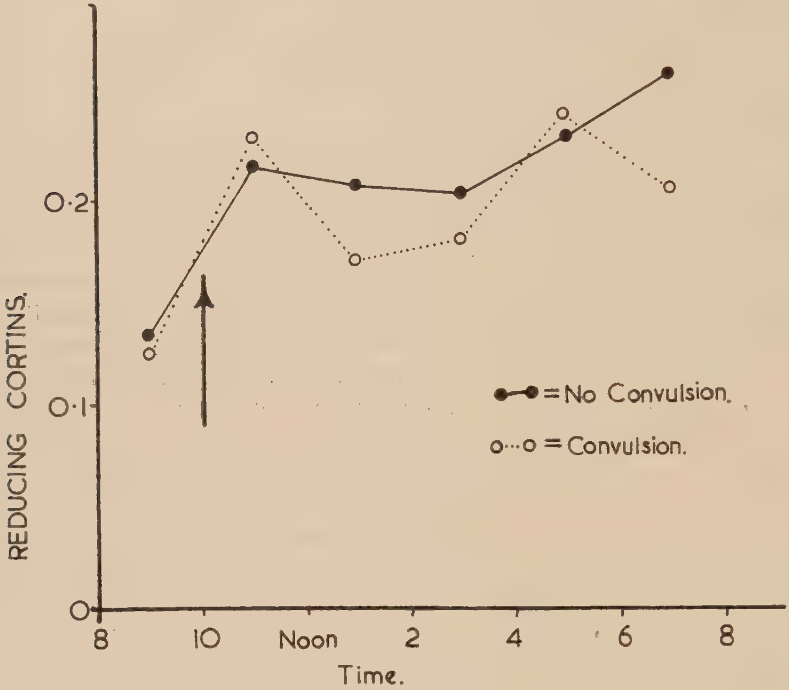

FIG. 8.—Excretions of reducing cortins (mgm. glucose equivalent) at 2-hourly intervals on days when a convulsion was administered (open circles) compared with the excretion on control days (solid circles). Each value is the mean of four days' observations. The arrow marks the administration of the convulsion.

None of the six differences exceed twice their standard deviation, so there is no evidence for any significant change in the excretion of reducing cortins in the first few hours after a convulsion.

The effects of convulsive therapy on steroid metabolism will now be described. Each patient will be described in turn, since the various assays are best related by describing their variations from day to day in each patient. The clinical descriptions given are very brief because we are interested primarily in determining the biochemical effects of the electrically-induced convulsion, the clinical states of the patients being of minor interest. Only if a much larger series of patients were available could the different biochemical responses be justifiably correlated with the different clinical types.

CASE I was a man aged 62, farmer by profession, who came from a healthy stock and had had no previous mental troubles. But a year before admission he had broken his arm at about the same time that a number of financial worries arose, and he began to find his difficulties too much for him. He became at first over-active, fussy, irritable and quarrelsome. Later he tended to neglect his work, to sit gazing in front of him, and he could hardly be persuaded to attend to his ordinary physical needs. His financial difficulties had become aggravated by his neglect, but help from relatives had been given. *On admission* he was apathetic almost to a stupor. His intellect was clear but his speech was slow and casual; his chief request was to be left alone. No hallucinations were present, but occasional remarks suggested that he was not completely free from delusions. Memory was not affected. *Convulsive therapy* was commenced. He responded well from the beginning, and after 12 fits was much improved. During convalescence he improved further, and was later able to resume work in an excellent remission.

The results of the assays are shown in Fig. 9.

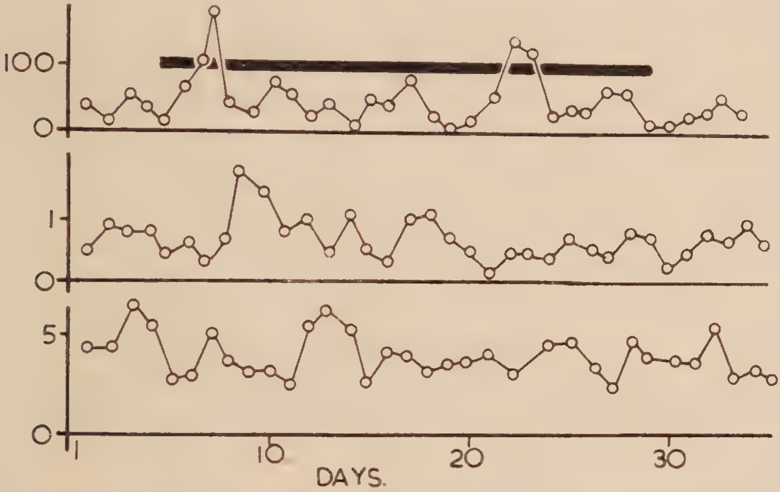

Fig. 9.—Case I: Excretions of sugar-active cortins (upper graph), reducing cortins (middle graph), and 17-ketosteroids (lower graph) before, during, and after convulsive therapy whose duration is shown by the thick horizontal line. The peaks in the excretions of cortins, at 3 and 4 days after the onset of treatment, are clearly shown.

Commentary.—The excretion of the "sugar-active" cortins is represented in Fig. 9 by the amount of glycogen deposited. Its most obvious feature is a peak occurring after the administration of the first convulsion, in this case at three days' distance. This sharp rise is, however, not maintained even briefly but falls at once to its previous level. Here it remains, with fluctuations, until a second peak occurs later in the treatment. This second peak has occurred in several other patients and will be discussed later. It has not usually been related to any definite incident in the treatment or in the patient's clinical progress.

The reducing cortins show a sharp rise in the amount excreted at five days after the administration of the first convulsion. This rise is not maintained, and the excretion over the rest of the interval remains at about the same level as before the treatment. Two points may be noted specially. The peak in the excretion of the reducing cortins occurred about two days after the peak in the excretion of the "sugar-active" forms. This delay, the reducing forms reaching a peak *after* the "sugar-active" forms have reached theirs, has occurred several times in this series, and no clear example has occurred to the contrary. The delay suggests that the two sets of cortins consist largely of separate substances, for if the peaks were due to the same substances they would have to rise and fall together, the differences between the methods of assay being quite unable to alter their timings.

The 17-ketosteroids show neither trend nor peak, and this has been the usual result in this series.

Case II was a man of 29 years, a forester by profession, and of good family history. He had joined the Forces in 1942 and had, for some months, served well and normally. But he gradually became more eccentric, developed various peculiar opinions, and was arrested for his unsoldierly behaviour and then sent to hospital. Delusions of persecution developed but his behaviour slowly improved, and he was discharged a year later sufficiently improved to look after himself. Four years later he developed an increasing depression, which was accompanied by various delusions of reference. He became restless, talkative, and at times incoherent. *On admission* he was suspicious, unco-operative, rather confused, and expressed delusions of persecution. Memory and orientation were not affected. *Convulsive therapy* was commenced, but the effect at first was small. A slow improvement occurred after the course was completed, and this improvement continued until he was discharged three months later. His condition was considered to be one of schizophrenia.

The results of the assays are given in Fig. 10.

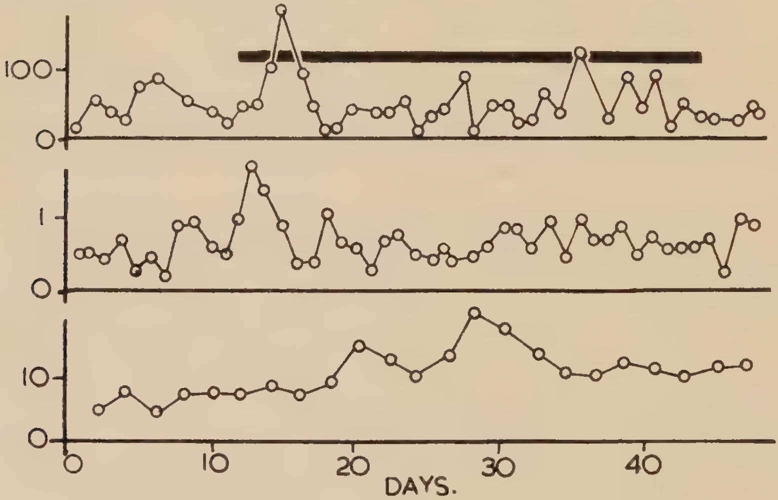

Fig. 10.—Case II: The same variables as in Fig. 9. The sharp response in sugar-active cortins at 3 days after the onset of treatment is clearly shown.

Commentary.—The sugar-active cortins show a marked peak of excretion after the administration of the first convulsion, in this case occurring two days later. After this peak the excretion of the sugar-active cortins falls rapidly to a level in this case, as often, below the usual average in the untreated state. After this initial surge the sugar-active cortins are excreted only at an average level in spite of the maintenance of treatment. The final level after treatment seems to differ little, if at all, from the general average.

The reducing cortins show, in their excretion, a peak similar to that shown by the sugar-active cortins. It occurs about two days after the administration of the first convulsion, and about one day after the peak in the sugar-active cortins. The surge is not maintained, and the excretion returns to its previous level.

The ketosteroids show a slow trend upwards, with two peaks at days 23 and 31, but their significance is doubtful.

Case III was a man aged 30, clerk, from a healthy family. He had served in the army during the war satisfactorily, though without distinction, but after demobilization he found difficulty in adapting to civilian life. About eighteen months before admission various vague symptoms began to appear. He felt "out of sorts," was irritable and moody. At times he would have to abandon his work during the day to return home. *On admission* he was depressed, irritable, anxious and querulous. He could give no particular reason for his moods, and felt that he must have some physical illness. *Convulsive therapy* was commenced, but after three applications he refused further treatment. His clinical response had been poor, and he showed little later improvement.

The results of the assays are shown in Fig. 11.

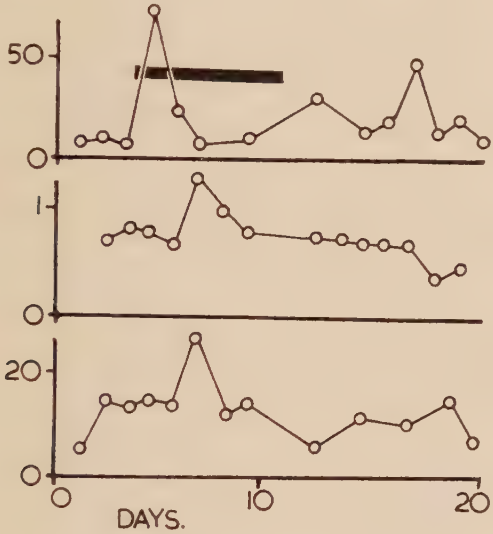

Fig. 11.—Case III. (Variables as in Fig. 9.)

Commentary.—These results again show the tendency for the first convulsion to evoke a marked outpouring of sugar-active cortins. In this case the excretion has increased to about six times the level it showed before the application of the treatment. The peak occurs in the same day as the first convulsion; but the peak may still be caused by the convulsion, as the assay is based on the urine which is passed in the 21 hours following the convulsion. The same earliness of response is seen in Case 9. Again it shows the usual rapid fall after a day or two.

The reducing cortins also seem to have been caused to rise, though not to the same degree. Again they show the feature noticed in several of these cases - that the peaks of the excretions of the two types of cortin do not occur simultaneously. In this case the reducing cortins have risen to a maximum three days after the sugar-active cortins had reached theirs. Again the evidence seems decisive that the two types of cortin are excreted independently.

The ketosteroids show a peak, but this can hardly be stressed, since it rests only on a single specimen and is not confirmed by the other patients.

Case IV was a young woman of 26 years, shorthand-typist, whose mother had been certified for melancholia. She had always been shy, timid, hesitant in making friends, conscientious and over-scrupulous. Three years prior to admission she had had an attack of depression which had lasted only about a fortnight and had not necessitated hospitalization. A second attack began gradually some months before admission. She became again depressed, agitated and sleepless. *On admission* she was deeply depressed, was apt to fall into fits of weeping, felt that life was impossible, and that she would never be "of any use." Insight, memory and orientation were good, and there were no delusions nor hallucinations. *Convulsive therapy* was commenced and induced a rapid improvement. After six convulsions she refused further treatment but was already much improved. Convalescence was rapid and she was discharged in a good remission.

The results of the assays are shown in Fig. 12.

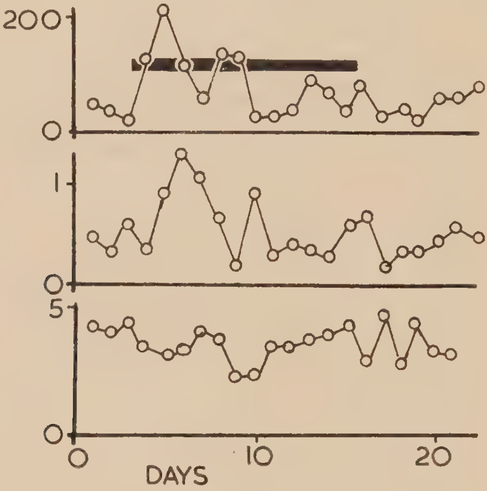

Fig. 12.—Case IV. (Variables as in Fig. 9.)

Commentary.—The sugar-active cortins show the usual peak after the administration of the first convulsion. But the rise is not maintained, and falls rapidly to the level shown before treatment.

The reducing cortins show a similar peak after the commencement of the treatment, the peak following that of the sugar-active cortins at about one day.

The ketosteroids show neither trend nor peak.

Case V was a young man aged 23, from a healthy family, and an officer in the R.A.F. He had no previous mental symptoms, but had been suffering for some months from increasing feelings of inferiority, of insufficiency, and of frustration. He was restless, worried, and unable to apply himself to his work. There was a suggestion that he might be invalided from the R.A.F., and insomnia contributed to his difficulties. *On admission* his symptoms were essentially those of anxiety and depression. There was no evidence of delusions or of hallucinations, and insight was good. *Convulsive therapy* soon produced a considerable amelioration, and after 12 convulsions had been given he was convalescent. His condition steadily improved, and later he left the hospital having made an excellent recovery.

The results of the assays are shown in Fig. 13.

Commentary.—The sugar-active cortins show fairly clearly the usual peak after the administration of the first convulsion. Afterwards the figure shows the unusual feature that the level is raised throughout the duration of the treatment, but falls sharply when the treatment was stopped.

The reducing cortins show the usual peak after the administration of the first convulsion, the excretion being about four times as large as at the remainder of the period of observation. The two peaks of the sugar-active cortins occurring after the first are not accompanied by any clear peak of the reducing cortins—again indicating their essential independence.

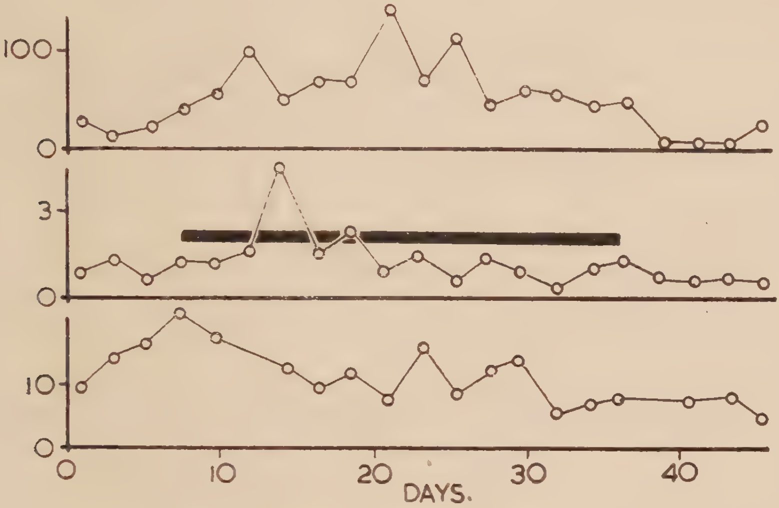

FIG. 13.—Case V. (Variables as in Fig. 9.)

The ketosteroids show, during the period of treatment, only a tendency to fall. They had commenced high, and the fall towards more normal values may be associated with the patient's clinical improvement. It may be noteworthy that the reducing cortins are also rather higher in this patient than in most.

CASE VI was a man of 51 years, clerk, with some history of "nerves" in the family. He had always been well until about six months before admission, when he became increasingly worried and anxious. Three weeks before admission a brother committed suicide, and this made him much worse. Trivialities disturbed him greatly, he became irritable and quarrelsome, but would also frequently burst into tears. His sleep became seriously impaired and he was unable to continue his work. *On admission* he was anxious and worried, showing alternately both apathy and depression. His intellect was unclouded and there was no evidence of delusions. Memory and orientation were normal and there were no hallucinations. *Convulsive therapy* was commenced. At first he showed little response, but after about the sixth convulsion he began to improve steadily. After completion of the treatment he still showed some residual symptoms, but he insisted on leaving and was discharged much improved.

The results of the assays are shown in Fig. 14.

Commentary.—The sugar-active cortins show a slight peak in their excretion two days after the administration of the first convulsion, but this is followed by a more obvious peak, which reaches a maximum about four days later. After this initial surge the values fall to a low or moderate level in spite of the continuation of the treatment.

The reducing cortins in this case show no clear evidence of any reaction to the treatment. It is interesting to note that the conspicuous but small peak on the 21st day is preceded at two days by another small but conspicuous peak in the excretion of the sugar-active cortins. As has been mentioned, this relationship has been observed several times.

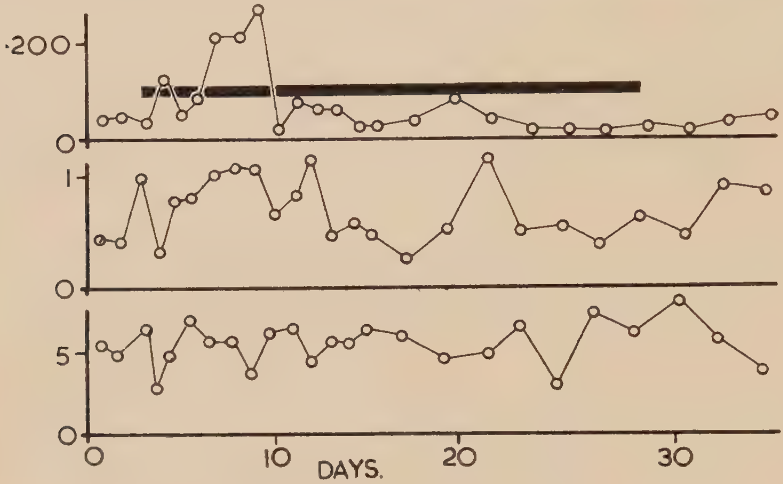

Fig. 14.—Case VI. (Variables as in Fig. 9.)

The ketosteroids show no particular trend. It may be noted that the high peak of sugar-active cortins, sustained over three days, is accompanied by no detectable change in the excretion of the ketosteroids.

Case VII was a man aged 55, a farmer, from a healthy family. He had had recurrent attacks both of depression and hypomania for fifteen years, but had always had normal interludes. About a year ago he became depressed for a time but was able to continue his work at home. He was attacked by a bull during his work and was shaken and concussed, and this seemed to alleviate his depression for a time, but he relapsed. He was unable to continue his work and was sleeping badly. *On admission* he was depressed and anxious. No delusions or hallucinations were observed. Intellect, memory and orientation were unimpaired. *Convulsive therapy* caused a rapid recovery, and he was later discharged in a good remission.

The results of the assays are shown in Fig. 15.

Commentary.—The sugar-active cortins show the usual peak after the administration of the first convulsion. The patient is unusual, however, in that the cortins show a trend upwards, the average level after the tenth day being as high as the initial peak.

The reducing cortins show a similar peak. Though not sharply distinguished from the adjacent values, it is nevertheless the highest value recorded.

The ketosteroids show neither peaks nor trends.

Case VIII was a widow aged 60, of good family history, who had lost her husband a year before admission to hospital and had become the proprietress of a nursing

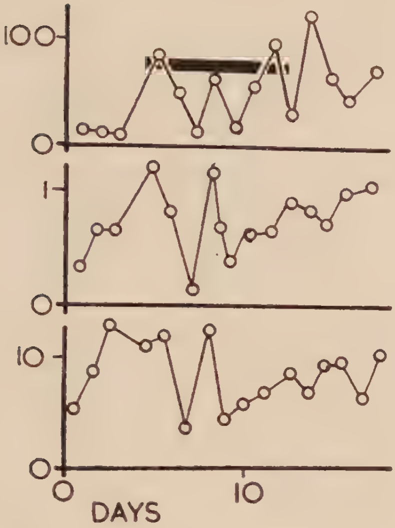

FIG. 15.—Case VII. (Variables as in Fig. 9.)

home. Previously her life had been healthy, but financial difficulties had added to her burden, and she had gradually become more depressed and anxious. Insomnia had developed, and she had become unable to do her work. *On admission* she was quiet, apathetic, mildly depressed and anxious Intellect, memory and orientation were unimpaired. There were no hallucinations and no delusions. *Convulsive therapy* was commenced and induced a rapid improvement. After the third application she felt so much better that she decided to resume her normal life forthwith.

The results of the rather brief investigations are shown in Fig. 16.

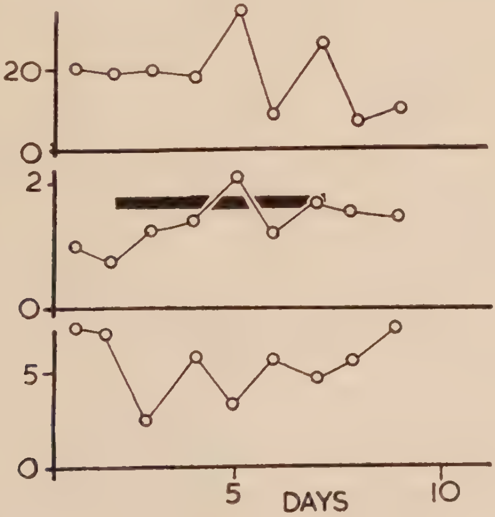

FIG. 16.—Case VIII. (Variables as in Fig. 9.)

Commentary.—The sugar-active cortins show the usual peak after the administration of the convulsive therapy, but in this case it does not appear till the fourth day, and is small in degree.

The reducing cortins also show a peak occurring on the same day. In this patient the general level of the reducing cortins was rather unusually high.

The ketosteroids seem to show little change. Comment is restricted by the brevity of the patient's treatment and investigation.

Case IX was a man aged 64, a solicitor's clerk, of a healthy family. He had been retired from his work about four months when he became increasingly apathetic. He tended to sit in one chair all day, and could be persuaded only with difficulty to come to meals or to bed. With this there was associated an increasing anxiety. He began to express fears that some disaster was coming, that his savings were lost, that his bodily health was failing. Sleep was impaired, and he had seemed to lose physical vigour. *On admission* he was depressed and agitated. He spoke fearfully of the future, but could give no clear reason for his fears. His intellect, memory and orientation showed no impairment. No hallucinations were present. Insight was partial. *Convulsive therapy* was commenced and he improved rapidly. After six convulsions he was feeling altogether better and he refused to accept further treatment. Recovery was uninterrupted, and promised to be complete when he left.

The results of the assays are shown in Fig. 17.

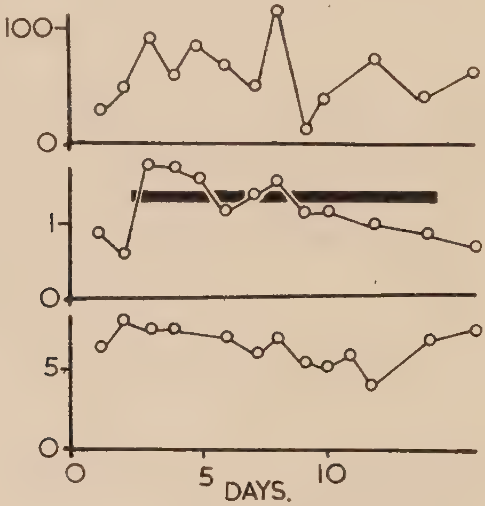

Fig. 17.—Case IX. (Variables as in Fig. 9.)

Commentary.—The sugar-active cortins show a peak occurring on the same day as the administration of the first convulsion. This peak may be due to the convulsion, as the assay is based on the urine which is passed in the 21 hours following the convulsion, The case is unusual in the earliness with which the peak has occurred, but the same feature occurs in Case 3.

That the peak may be a genuine response to the treatment is supported by the fact that the reducing cortins show a peak, more clearly marked, also occurring during the first day of treatment. After the peak, the reducing cortins fall slowly, differing in this case from the majority, where the peaks falls sharply.

The ketosteroids show neither trend nor peak.

Case X was a young man of 23, of a healthy family. He served during the war in the R.A.F., and was demobilized in a state of good health. After a few months, spent living at home, he quarrelled with his family and went to live in lodgings. He gradually became apathetic, preoccupied with various minor troubles, and seemed unable to obtain employment. Some obsessional features became more marked, chiefly of a homosexual type. *On admission* he was apathetic, mildly irritable, content to sit about the ward inactive, and with no thought for the future. His opinions were somewhat bizarre at times, but he was not deluded. Memory and orientation were unimpaired. There was no evidence of hallucination. He was considered to be a schizophrenic of simple type. *Convulsive therapy* was commenced. A slight increase in activity occurred, but the effect was trivial and the course of treatment produced little change. He was investigated by us for five days prior to treatment and during the first seven days only of his treatment.

The results of the assays are shown in Fig. 18.

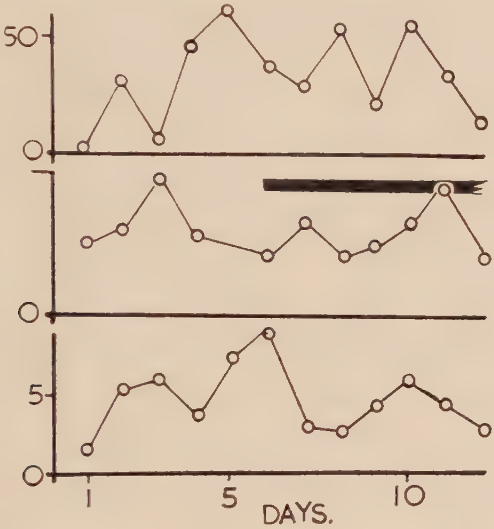

FIG. 18.—Case X. (Variables as in Fig. 9.)

Commentary.—In this case there seems to be little to say except that the treatment seems, at least during the first seven days, to have produced no effect on the excretions of the three types of steroids.

CASE XI was a man of 52, a school-teacher by profession, with a family history which included two certifications, apparently for mania. He had always been highly active, jovial, sociable, and a vigorous personality. Eight years before admission he had had a "nervous breakdown," which had been treated in his home and which seemed to be of depressive type. Two months before admission his personality had again changed, and he had begun to have forebodings about the future, to feel that he was "done for," and that some crime was going to be attributed to him. His sleep was disturbed, he lost weight rapidly, and had spoken several times of suicide. *On admission* he was depressed and anxious. He spoke in a whisper of his unworthiness and of his sins. His intellect, though disturbed by his depression, was not impaired. Memory and orientation were normal. Hallucinations were suspected, but were not admitted. *Convulsive therapy* was commenced. It induced so rapid an initial improvement that he seemed likely to pass into mania, but the treatment was continued, the over-excitement subsided, and by the end of the course of treatment he had made a good recovery.

The results of the assays are given in Fig. 19.

Commentary.—The sugar-active cortins show the usual peak, but only after an unusually long delay. At five days after administration of the first convulsion there is a slight elevation of doubtful significance, and a well-marked peak does not occur until about nine days after the first convulsion. The quantity excreted then shows the usual immediate return to the general level.

The reducing cortins show little for comment. There is a slight peak occurring 15 days after the first convulsion, but its significance is doubtful. On the whole there seems to be little change.

The ketosteroids show no trend and no clearly marked peaks.

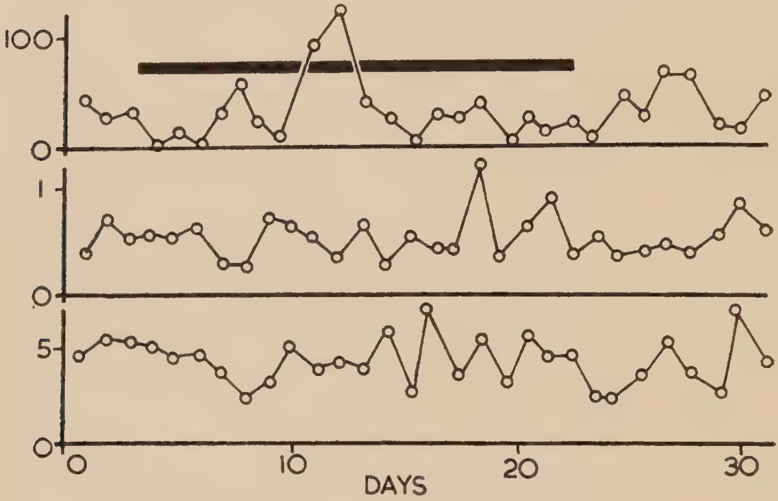

FIG. 19.—Case XI. (Variables as in Fig. 9.)

CASE XII was a man of 46, unmarried, an accounting clerk, of a healthy family. He had always been frail in health, and had lived a quiet and monotonous life in lodgings, his only interest apart from his work being in stamp-collecting, though here his enthusiasm was small. During the last few years he had become less sociable, less communicative to his fellow-workers and to his landlady, and his few living relatives ceased to hear from him. About two years before admission he started to complain to his landlady of various annoyances. His complaints increased in number and in bizarreness until she communicated with his relatives, who persuaded him to come to hospital. *On admission* he stated that he had been brought unwillingly, but made no attempt to leave. His memory and orientation were unimpaired, though he gave curious and illogical reasons for some of his everyday actions. No hallucinations were observed. *Convulsive therapy* was tried but seemed to add only a confusion to his other symptoms, and it was discontinued after seven applications.

The results of the assays are shown in Fig. 20.

Commentary.—The sugar-active cortins show their usual peak after the administration of the first convulsion, the peak in this case occurring six days after it. A second peak occurred ten days later when treatment had been discontinued for two days, but the interpretation must here proceed with caution. Convulsions are given usually at intervals of two or three days, so that in the day or two which follows a given convulsion there is no objective distinction between treatments which have, and which have not, ended, only the occurrence or non-occurrence of later treatments providing the distinction.

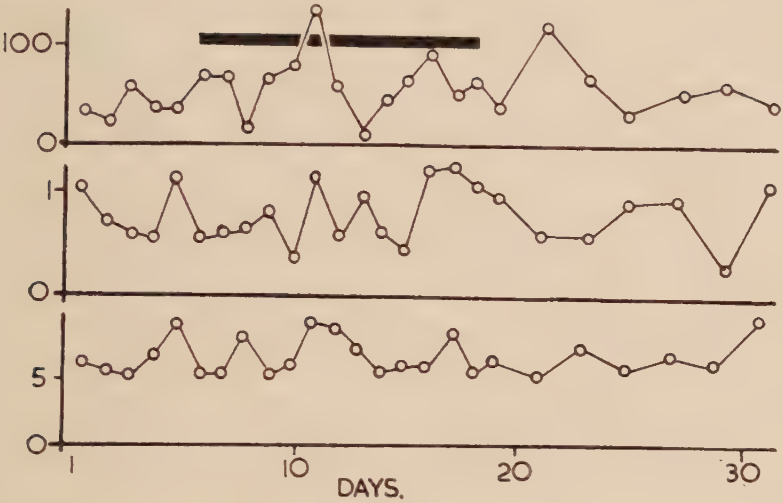

FIG. 20.—Case XII. (Variables as in Fig. 9.)

For this reason the end of the treatment cannot be assigned sharply to a particular day, but must be considered to be spread over several days.

The reducing cortins show several irregular small peaks, but as none rise appreciably above the level which occurred before treatment was commenced their significance is probably small.

The ketosteroids show no trend and no clearly defined peaks.

CASE XIII was a man aged 38, a physicist, of a healthy family. He had always been healthy until four days before admission, when he had received from his employers a presentation on the occasion of his leaving. He had attempted, in the presence of all the staff, to express his thanks, when he became confused, excited and incoherent. His condition rapidly deteriorated. *On admission* he was excited, talked incessantly, and could be controlled only with difficulty. He said that he was God, that his assistants were his disciples, and that Winston Churchill was under the bed. He was disorientated, and visual hallucinations were present. *Convulsive therapy* was commenced, and his condition started to improve, but the response was poor, improvement was slow, and after twelve convulsions he still showed some excitement and restlessness, though this fluctuated from day to day.

In spite of his mania the collection of urine was accurate and complete.

The results of the assays are shown in Fig. 21.

Commentary.—The excretion of sugar-active cortins is anomalous. The treatment produces no immediate effect, but later there occurs a diminution of excretion extending over about eight days followed by two peaks of excretion, not obviously related to any cause.

The reducing cortins show the usual peak after the administration of the first convulsion. Later changes are small, though there is a sharp peak at the 21st day, preceded at one day by a peak in the sugar-active cortins. Their essential independence is, however, emphasized by the failure of any peak to occur in the reducing cortins after the obvious peak which occurs in the sugar-active cortins around the 28th day.

The ketosteroids show no systematic change.

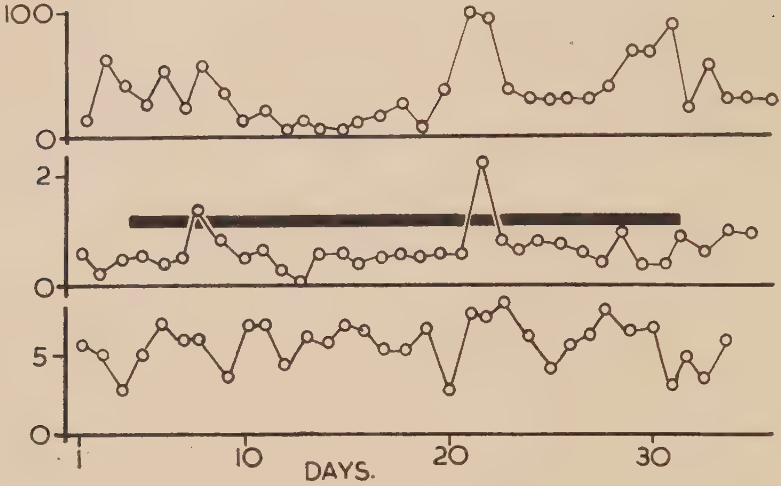

FIG. 21.—Case XIII. (Variables as in Fig. 9.)

CASE XIV was a man aged 41, a farmer, of a healthy family. Six years before admission he had a first attack of depression with delusional ideas, but he recovered after a brief treatment. Two years later his symptoms began to recur. He again became deeply depressed, developed ideas of reference and of persecution, and was aurally hallucinated. After a course of electrically-induced convulsions he improved rapidly and was discharged after three months.

Five years later the present attack began. His depression recurred, he attempted suicide, and he was readmitted with symptoms similar to those of his previous attack. *On admission* he was suffering from a throat wound which had needed 25 stitches. He believed that the police were after him and that he was to be parted from his family by them. His conversation was rambling and rather confused. Hallucinations were present, but memory and orientation were unimpaired.

Because of the wounds in his throat convulsive therapy was delayed until healing was more advanced. During this interval of delay he had repeated pains in the left leg, though there was no sign to indicate its cause. When the throat wound was healed *convulsive therapy* was commenced. Later, just after its termination, a frank thrombosis developed in the deep veins of this leg, followed by a fever which lasted several days. There is reason, therefore, to believe that some phlebitis had been present in the leg throughout the interval before the convulsive therapy. Because of the postponement of treatment the records prior to the convulsive therapy are unusually long, but their interpretation is complicated by the simultaneous phlebitis.

The results of the assays are shown in Fig. 22.

Commentary.—The sugar-active cortins frequently rise to a high level before the convulsive therapy has been started. These high levels have been seen in none of the other patients prior to treatment, and are possibly associated with the accompanying phlebitis. The convulsive therapy causes no particular increase in the excretion of the sugar-active cortins.

The reducing cortins show no clear reaction to the convulsive therapy. In this patient the peaks in the types of cortins show no particular relations to one another in timing, again suggesting the essential independence of their variations.

The ketosteroids show no trend, and only irregular variations. The low level which appears during the convulsive therapy is probably not of significance.

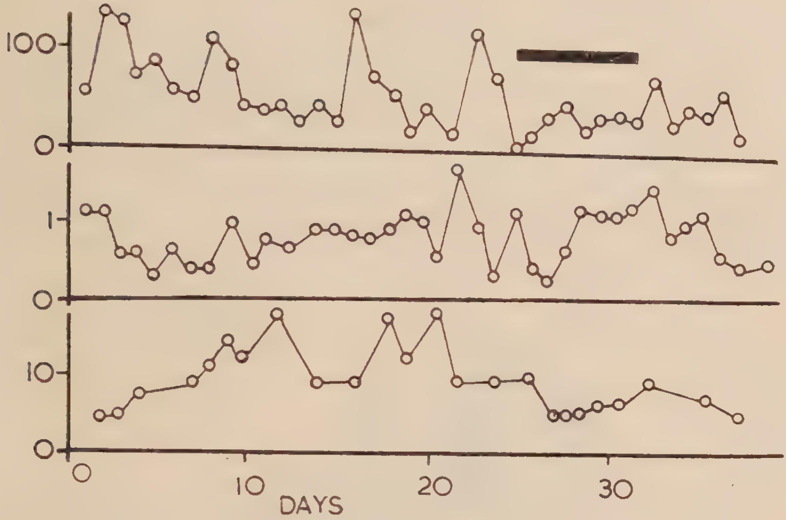

FIG. 22.—Case XIV. (Variables as in Fig. 9.)

This review of the individual cases completes the statement of the results of the investigations. It now remains to assemble these results and to discuss their significance.

DISCUSSION.

The peaks in the excretions of the sugar-active and of the reducing cortins may first be examined. Their reality can hardly be doubted. There is the fact that of the 14 patients, such peaks are shown by 12. There is the fact that of all the peaks, not one occurs in the periods of observation prior to the treatment (excepting only Case XIV, whose exceptional features have been noted). There is the fact that in many cases a peak in the sugar-active cortins is followed in a day or two by a peak in the reducing cortins, the reversed sequence never occurring; and these two peaks are based on two methods of assay sufficiently different in principle to offer independent evidence. And there is the fact that the peaks occur more frequently in the few days after the first convulsion than at any other time. This relationship to the first convulsion is shown in Fig. 23 by the number of peaks that have occurred on each day after the first convulsion.

The figure shows clearly both the tendency for the peaks to occur within about the first seven days after the first convulsion, and also their appearance only after the first convulsion has been given. These then, are the first features.

A third feature, mentioned earlier, is the relationship in time between the peaks of sugar-active cortins and those of the reducing cortins. In every case where a peak of each type occurs (in Cases I, II, III, IV, V, VII, VIII, and IX) the two peaks either occur on the same day, or that of the reducing cortins follows that of the sugar-active cortins by a day or two. A reversed temporal order does not occur. Its significance will be discussed later.

A fourth feature is that, although the peaks of the two types of cortins may be related in time, yet the frequent occasions on which they occur independently show that the peaks cannot be caused by the same chemical substances. Thus in Case I, on the fourth day after the first convulsion, sugar-active cortins have passed their peak and are falling, while the reducing cortins have not yet started to increase. The evidence suggests then that the two methods of assay are measuring two sets of steroids which are not identical.

The results for the 17-ketosteroids are soon summarized, for, excepting Case III, they show neither trend nor peak. And finally, the peaks in the excretion of cortins, though frequent, show no tendency to be associated with peaks in the excretion of the 17-ketosteroids.

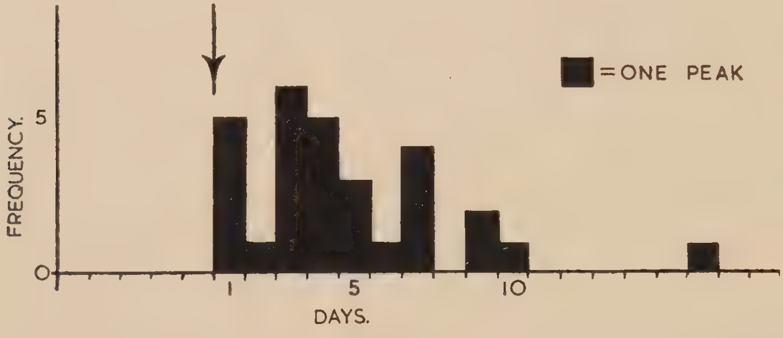

FIG. 23.—Twenty-nine peaks distributed according to their day of occurrence after the onset of convulsive therapy (marked by the arrow). The control period before the therapy is void. Eighty-six per cent. of the peaks occur within 7 days of the onset of treatment.

This completes the summary of the direct results of the assays of the various steroids. A natural question to answer next is whether the results, and particularly the occurrences of the peaks, show correlation with the degrees of clinical improvement. The association is not obvious, so in Table XV the

TABLE XV.—*Clinical Improvement and Peaks in Cortin Excretion.*

Case No.	Occurrence of peak.			Clinical improvement.
	Sugar-active cortins.	Reducing cortins.	17-keto-steroids.	
I	+	+	0	++
II	+	+	0	+
III	+	+	+	0
IV	+	+	0	++
V	+	+	0	++
VI	+	0	0	+
VII	+	+	0	++
VIII	0	+	0	++
IX	+	+	0	++
X	0	0	0	0
XI	+	0	0	++
XII	+	0	0	0
XIII	0	+	0	0
XIV	0	0	0	+

relevant facts are summarized for each patient. Whether or not a peak has occurred is shown by + or 0, the sugar-active and the reducing cortins being shown separately. The degree of clinical improvement, which cannot be measured with precision, is shown in the classes " good, moderate, or poor " by the signs ++, +, or 0 respectively.

If we divide the fourteen patients into groups according to whether they do or do not show a peak in their sugar-active cortins, and also according to their degree of clinical improvement, we find them to be divided as in Table XVI, in which is also shown the same grouping for the reducing cortins.

TABLE XVI.—*Clinical Improvement and Peaks in Cortin Excretion.*

		Peak in cortins.			
		Sugar-active.		Reducing.	
		+	0	+	0
Clinical improvement	++	7	0	6	1
	+	2	1	1	2
	0	2	2	2	2

There is no satisfactory method for testing the statistical significance of a 2 × 3 table when the numbers are too small for the χ^2-test, but we may obtain an approximation by combining the two classes " moderate " and " poor." We now get two tables, each 2 × 2, with the contents

7, 0 ; 6, 1
4, 3 ; 3, 4

suitable for testing by Fisher's exact method (1941). There are two hypotheses which may be used for testing the significance ; but as we do not know which is the true one, we may test both, and then draw our deductions. The first method assumes that the peaks in the two types of cortin are occurring independently. In this case we may combine the two tables to provide one table showing the occurrence of peaks generally in the two degrees of clinical improvement ; we get

13, 1
7, 7

Its value of P by the method quoted is 0·016. The second method assumes that the peaks are not entirely independent, so here we must keep the two tables apart ; their values of P are 0·096 and 0·133 respectively. The true value of P lies, therefore, somewhere between about 0·10 and 0·016, i.e., in the region of the 5 per cent. level of significance. We should therefore say that the results suggest that the occurrence of a peak tends to be associated with " good " clinical improvement, but that the data are not quite decisive.

This deduction completes the statement of the results of the assays in this series of patients ; they may be compared with those obtained by Hemphill, MacLeod and Reiss (1942), who are, as far as we are aware, the only workers who have previously contributed to this subject. They examined the effects of convulsive therapy on the rates of excretion of the 17-ketosteroids only. Their chemical method was the same as ours, but they examined their patients twice only—once before and once after the course of convulsive therapy. Of their 18 patients, they considered that 9 showed a " significant " increase in the rate of excretion. But as the criterion of a " significant " increase was decided arbitrarily, with no evidence to demonstrate its validity, and as no statistical test of the significance was applied, it is possible that the discrepancy between their results and ours may be less than it seems at first sight. Both sets of data, when combined, suggest that during and after convulsive therapy the excretion of 17-ketosteroids, if it changes at all, can change but slightly.

Having reviewed the primary facts, we may now turn to some questions which need discussion.

A first question to be discussed is whether the changes in the excretions of the cortins may be due simply to the muscular efforts made during the convulsion. The question may reasonably be asked, for Venning and Kazmin (1946) reported that the urinary cortins were increased in soldiers after a route march. But the evidence seems to be against the suggestion. Contrary to Venning and Kazmin, no evidence of any increase after exercise was found by Talbot, Albright, Saltzman, Zygmuntowicz and Wixom (1947). Our own results, too, are against the suggestion. There is the obvious fact that, as shown in most of the graphs of the patients' results, convulsions often fail to be followed by a peak: were the peaks due to the muscular effort, we would expect a peak after every convulsion. There is the fact that the peaks, typically, do not occur until a few days after the first convulsion; were they due to the muscular effort we would expect the convulsion to evoke a peak within a few hours. And finally, there is the fact that a direct study, reported above, of the excretion of the cortins in the five 2-hourly periods immediately following the convulsion shows no evidence for any change in the excretion of cortins during this time. The whole evidence, therefore, seems to be against the suggestion that the muscular effort is the cause of the observed peaks.

The next question which arises is whether the peaks are the end-results of a secretion of corticotrophic hormone.

We have shown earlier in the paper that there are strong reasons for thinking that the urinary cortins measured by our assays originate in the adrenal cortex, and that increases in their output reflect increases in the output of adrenal steroids. This being so, no stimulus for their release is known other than the corticotrophic hormone. Vogt (1945), it is true, has shown in the dog that the continued administration of adrenaline results in hypertrophy of the adrenals, but this occurred only after 24 days—a delay too long to be applicable to our results.

In favour of the hypothesis that the peaks are due to corticotrophic hormone is the fact that the time-relations of the peaks to the onset of the convulsive therapy are what would be expected. Although the first effects of corticotrophic hormone are shown in the adrenal cortex within an hour or two (Sayers, Sayers, Liang and Long, 1946), yet these are the very earliest effects; the full effect develops only over several days. Thus, when pure corticotrophic hormone was administered to the human being (Mason, Power, Rynearson, Ciaramelli, Li and Evans, 1947), some days elapsed before the urinary cortins rose to their maximum. Again, when the body is subjected to severe trauma, the output of urinary cortins has been found to rise day by day, a maximum being reached at about seven days after the injury (Schenker and Stevenson, 1943). It seems then that the timing of the peaks in relation to the administration of the first convulsion, and their evocation by corticotrophic hormone, are compatible.

The rapid fall after the peak is also compatible with such an evocation, for Sayers and Sayers (1947) have shown that an increase of adrenal cortical steroids in the circulating blood causes inhibition at the adenohypophysis of the secretion of further corticotrophic hormone. This may explain the feature, seen in several of the graphs of our patients' excretions of cortins, that a peak is often followed by an unusually low value.

On the other hand, the hypothesis that the peaks are the results of a sudden secretion of corticotrophic hormone involves at least one difficulty. The three types of steroids measured by our assays have been shown to rise and fall independently, peaks of each occurring sometimes without peaks of the others; it is difficult, therefore, to relate their peaks to a single factor. That the reducing cortins usually follow, by a day or two, the sugar-active cortins would be explained if the adrenal cortex responded to a single stimulus with a sequence of activities, secreting first the sugar-active and then the reducing cortins. But this can hardly explain the occurrence of a peak of one type without any accompanying peaks of the others; and such isolated peaks are too common in our series to be ignored.

These difficulties persist only so long as we try to ascribe the evocation of the peaks to a single substance. If we are prepared to assume that the system which responds to the convulsive therapy, and which evokes the cortins, is more complex than a single entity, then the difficulties disappear. There seems to be nothing inherently improbable in this suggestion. The pituitary secretes more than one hormone, and the hypothalamus contains more than one centre. But our work was designed, not to explore these complex possibilities, but to establish the primary facts. So further discussion must be restrained.

SUMMARY.

The work is a study of the effects of convulsive therapy on the activities of the adrenal cortex.

Three types of adrenal cortical steroids have been studied: the "sugar-active" cortins, the "reducing" cortins, and the 17-ketosteroids.

Their excretion-rates have been followed in 14 patients before, and during, convulsive therapy.

It has been found that:

(1) The usual effect of convulsive therapy is to cause a brisk outpouring of adrenal cortical steroids during the first few days of the treatment.

(2) After this outpouring the activity returns to its previous level even though the treatment continues.

(3) The 17-ketosteroids show, in almost all cases, no changes in their excretion rate.

(4) There is evidence suggesting that the occurrence of a brisk outpouring of adrenal cortical steroids is associated with a greater tendency to clinical recovery.

The significance of these results is discussed.

References.

Artom, C., Fishman, W. H., and Morehead, R. P. (1945), *Proc. Soc. Exp. Biol. and Med.*, **60**, 284.

Best, C. H., and Solandt, D. Y. (1940), *Canad. M.A.J.*, **43**, 206.

Bourque, J. E., Haterms, H. O., and Glassco, E. (1943), *Proc. Soc. Exp. Biol. and Med.*, **52**, 313.

Britton, S. W., and Silvette, H. (1932), *Am. J. Physiol.*, **100**, 693.

Butler, G. C., and Marrian, G. F. (1937), *J. biol. Chem.*, **119**, 565.

Callow, N. H. (1939), *Biochem. J.*, **33**, 559.

Idem, Callow, R. K., and Emmens, S. W. (1939), *ibid.*, **32**, 1312.

Cole, W. H. (1944), *Am. J. Physiol.*, **141**, 165.

Cope, O., and Moore, F. D. (1944), *J. clin. Invest.*, **23**, 241.

Cuyler, W. K., Ashley, C., and Hamblin, E. C. (1940), *Endocrin*, **27**, 177.

Daughaday, W. H., Jaffe, H., and Williams, R. H. (1948), *J. clin. Endocrin.*, **8**, 166.

Deane, H. W., and Greep, R. O. (1946), *Am. J. Anat.*, **79**, 117.

Dorfmann, R. I. (1941), *Proc. Soc. Exp. Biol. and Med.*, **46**, 351.

Idem, Horwitt, B. N., and Shipley, R. A. (1944), *Endocrin.*, **35**, 121.

Idem, Horwitt, B. N., Shipley, R. A., and Abbott, W. E. (1944), *ibid.*, **35**, 15.

Idem, Ross, E., and Shipley, R. A. (1946), *ibid.*, **38**, 178.

Idem, Shipley, R. A., Ross, E., Schiller, S., and Horwitt, B. N. (1946), *ibid.*, **38**, 189.

Idem, Shipley, R. A., Schiller, S., and Horwitt, B. N. (1946), *ibid.*, **38**, 165.

Eggleston, N. M., Johnston, B. J., and Dobriner, K. (1946), *ibid.*, **38**, 197.

Everse, J. W. R., and de Fremery, P. (1932), *Acta Brev. Neerland. Physiol., Pharmacol., Microbiol.*, **2**, 152.

Eversole, W. J., Gaunt, R., and Kendall, E. C. (1942), *Am. J. Physiol.*, **135**, 378.

Feenders, H. (1936), *Frankfurt. Ztsch. f. Path.*, **49**, 411.

Fish, W. R., and Dorfmann, R. I. (1944), *Endocrin.*, **35**, 22.

Fisher, R. A. (1937), *The Design of Experiments.* Edinburgh. 2nd edition.

Idem (1941), *Statistical Methods for Research Workers.* Edinburgh. 8th edition.

Fleming, G. W. T. H., Golla, F. L., and Walter, W. G. (1939), *Lancet*, **2**, 1353.

Folley, S. J., and Greenbaum, A. L. (1946), *Biochem J.*, **40**, 46.

Fowler, J. L. A. (1944), *Canad. Med. Assoc. J.*, **50**, 416.

Fraser, R. W., Forbes, A. P., Albright, F., Sulkowitch, H., and Reifenstein, E. C. (1944), *J. clin. Endocrin.*, **1**, 234.

Good, C. A., Kramer, H., and Somogyi, M. (1933), *J. biol. Chem.*, **100**, 485.

Goodman, L. S., Swinyard, E. A., and Toman, J. E. P. (1946), *Arch. Neurol. Psychiat.*, **56**, 20.

Graham-Bryce, I., Bullen, A. K., and Forbes, W. H. (1945), *Psychosom. Med.*, **7**, 353.

Grattan, J. F., and Jensen, H. (1940), *J. biol. Chem.*, **135**, 511.

Idem, Jensen, H., and Ingle, D. J. (1941), *Am. J. Physiol.*, **134**, 8.

Hagedorn and Jensen (1923), *Biochem. Z.*, **135**, 46.

Harrop, G. A., and Thorn, G. W., (1937), *J. clin. Invest.*, **16**, 659.

Heard, R. D. H., and Sobel, H. (1946), *J. biol. Chem.*, **165**, 687.

Idem, Sobel, H., and Venning, E. G. (1946), *ibid.*, **165**, 699.

Hemphill, R. E., MacLeod, L. D., and Reiss, M. (1942), *J. Ment. Sci.*, **88**, 554.

Idem and Reiss, M. (1947), *Endocrin.*, **41**, 17.

Hirschmann, H. (1943), *J. biol. Chem.*, **150**, 363.

Huizenga, K. A., Brofman, B. L., and Wiggers, C. J. (1943), *J. Pharmacol.*, **78**, 139.

Ingle, D. J. (1940), *Proc. Soc. Exp. Biol. and Med.*, **44**, 176.

Idem (1941*a*), *Am. J. Physiol.*, **132**, 670.

Idem (1941*b*), *Endocrin.*, **29**, 649.

Idem (1941*c*), *Am. J. Physiol.*, **133**, 337.

Idem (1943), *ibid.*, **139**, 460.

Idem and Kuizenga, M. H. (1945), *Endocrin.*, **36**, 218.

Idem (1945), *Am. J. Physiol.* **145**, 203.

Ingle, D. J., Sheppard, R., Evans, J. F., and Kuizenga, M. H. (1945), *Endocrin.*, **37**, 341.

Katz, L. N., Killian, S. T., Asher, R., and Perlov, S. (1942), *Am. J. Physiol.*, **137**, 79.

KEATING, F. R., RYNEARSON, E. H., and POWER, M. H. (1942), *J. clin. Endocrin.*, **2**, 53.
KENDALL, E. C. (1942), *Endocrin.*, **30**, 853.
KEPL, M., CALDWELL, G., and OCHSNER, A. (1943), *Proc. Soc. Exp. Biol. and Med.*, **52**, 24.
KERMAN, E. G. (1947), *Dis. Nerv. Syst.*, **8**, 313.
KOCHAKIAN, C. D. (1944), *J. biol. Chem.*, **155**, 579.
KOSTER, H., and KASMAN, L. P. (1942), *Arch. Surg.*, **45**, 272.
KUIZENGA, M. H., and CARTLAND, G. F. (1939), *Endocrin.*, **24**, 526.
Idem, NELSON, J. W., and CARTLAND, G. F. (1940), *Am. J. Physiol.*, **130**, 1.
LEVIN, L. (1945), *Endocrin.*, **37**, 34.
LEWIS, R. A., THORN, G. W., KOEPF, G. F., and DORRANCE, S. S. (1942), *J. clin. Invest.*, **21**, 33.
LI, C. H., KALMAN, C., EVANS, H. M., and SIMPSON, M. E. (1946), *J. biol. Chem.*, **163**, 715.
LONG, C. N. H. (1942), *Endocrin.*, **30**, 870.
Idem, FRY, E. G., and THOMPSON, K. W. (1938), *Am. J. Physiol.*, **123**, 130.
Idem, KATZIN, B., and FRY, E. G. (1940), *Endocrin.*, **26**, 309.
LOWENSTEIN, B. E., and ZWEMER, R. L. (1943), *ibid.*, **33**, 361.
MCQUARRIE, I., ANDERSON, J. H., and ZIEGLER, M. R. (1942), *J. clin. Endocrin.*, **2**, 406.
MADDEN, S. C. (1946), *Surg. Gynec. Obst.*, **82**, 131.
Idem and WHIPPLE, G. H. (1946), *Am. J. med. Sci.*, **211**, 149.
MARRIAN, G. F. (1947), personal communication.
MASON, G., and HOFFMANN, M. M. (1945), *Endocrin.*, **27**, 111.
MASON, H. L. (1939), *ibid.*, **25**, 405.
Idem, POWER, M. H., RYNEARSON, E. H., CIARAMELLI, L. C., LI, C. H., and EVANS, H. M. (1948). *J. clin. Endocrin.*, **8**, 1.
MATHER, K. (1943), *Statistical Analysis in Biology*. London.
MATTHEWS, H. B. (1939), *J.A.M.A.*, **113**, 1183.
MONTIGEL, C. (1943), *Helv. Chim. Acta*, **26**, 883.
Idem and VERZAR, F. (1943*a*), *Helv. Physiol. Pharmacol. Acta*, **1**, 115.
Idem (1943*b*), *ibid.*, **1**, 137.
Idem (1943*c*), *ibid.*, **1**, 143.
NOBLE, R. L., and COLLIP, J. B. (1942), *Quart. J. exp. Physiol.*, **31**, 201.
OLSON, R. E., JACOBS, F. A., RICHERT, D., THAYER, S. A., KOPP, L. J., and WADE, N. (1944), *Endocrin.*, **35**, 430.
Idem, THAYER, S. A., and KOPP, L. J. (1944), *ibid.*, **35**, 464.
PERLA, D., and MARMORSTON-GOTTESMAN, J. (1931), *Proc. Soc. exp. Biol. and Med.*, **28**, 1024.
PFIFFNER, J. J. (1942), *Adv. in Enzymol.*, **2**, 349.
Idem, SWINGLE, W. W., and VARS, H. M. (1934), *J. biol. Chem.*, **104**, 701.
Idem, VARS, H. M., and TAYLOR, A. R. A. (1934), *ibid.*, **106**, 625.
PINCUS, G., and HOAGLAND, H. (1944), *J. Aviation Med.*, **15**, 98.
Idem and HOAGLAND, H. (1945), *Psychosom. Med.*, **7**, 342.
PRICE, W. H., SLEIN, M. W., COLOWICK, S. P., and CORI, C. F. (1946), *Federat. Proc.*, **5**, 150.
PUCHKOV, A. N. (1937), *Arch. biol. Nauk.*, **45**, 153.
RALLI, E. P. (1946), *Endocrin.*, **39**, 225.
REICHSTEIN, T. (1936), *Helv. Chim. Acta*, **19**, 29.
Idem (1937), *ibid.*, **20**, 817.
REIFENSTEIN, E. C., Jnr., FORBES, A. P., ALBRIGHT, E., DONALDSON, E., and CARROLL, E. (1945), *J. clin. Invest.*, **24**, 416.
REINECKE, R. M., and KENDALL, E. C. (1942), *Endocrin.*, **31**, 573.
Idem (1943), *ibid.*, **32**, 505.
REISS, M., MACLEOD, L. D., and GOLLA, Y. M. L. (1943), *J. Endocrin.*, **3**, 292.
REMINGTON, J. W. (1940), *Endocrin.*, **26**, 631.
Idem (1943), *ibid.*, **32**, 129.
RIML, O. (1939), *Klin. Wchnschr.*, **18**, 265.
SAYERS, G., and SAYERS, M. A. (1947), *Endocrin.*, **40**, 265.
Idem, LIANG, T. Y., and LONG, C. N. H. (1945), *ibid.*, **37**, 96.
Idem (1946), *ibid.*, **38**, 1.
SELYE, H. (1937), *Endocrin.*, **21**, 169.
Idem (1942), *J. lab. clin. Med.*, **27**, 1051.
Idem (1946), *J. clin. Endocrin.*, **6**, 117–230.
Idem and DOSNE, C. (1939), *Proc. Soc. exp. Biol. and Med.*, **42**, 580.
Idem and SCHENKER, V. (1938), *ibid.*, **39**, 518.
SCHARRER, E., and SCHARRER, B. (1937), *Biol. Rev.*, **12**, 185.
SCHENKER, V., and STEVENSON, J. A. P. (1943), *Conference on Bone and Wound Healing*, **4**, 91.
SCHILLER, S., and DORFMANN, R. I. (1943), *Endocrin.*, **33**, 402.
SCHLESER, I. H., and ASHER, R. (1942), *Am. J. Physiol.*, **138**, 1.
SEMMANN, W. (1940), *Z. Kinderheilk.*, **62**, 65.
SHIPLEY, R. A., DORFMANN, R. I., BUCHWALD, E., and ROSS, E. (1946), *J. clin. Invest.*, **25**, 674.
SPIEGEL, E., and WYCIS, H. (1945), *J. lab. clin. Med.*, **30**, 947.
STAINBROOK, E. (1947), *Psychosom. Med.*, **9**, 256.
STEWARD, F. C., and PRESTON, C. (1940), *Plant Physiol.*, **15**, 23.
SWANN, H. G. (1940), *Physiol. Rev.*, **20**, 493.

Swingle, W. W., Remington, J. W., Drill, V. A., and Kleinberg, W. (1942), *Am. J. Physiol.*, **136**, 567.

Idem, Overman, R. R., Remington, J. W., Kleinberg, W., and Eversole, W. J. (1943), *ibid.*, **139**, 481.

Talbot, N. B., Albright, F., Saltzman, A. H., Zygmuntowicz, A., and Wixom, R. (1947), *J. clin. Endocrin.*, **7**, 331.

Idem, Butler, A. M., and MacLachan, E. (1940), *J. biol. Chem.*, **132**, 595.

Idem and Langstroth, G. O. (1939), *Endocrin.*, **25**, 729.

Idem, Saltzman, A. H., Wixom, R. L., and Wolfe, J. K. (1945), *J. biol. Chem.*, **160**, 535.

Thayer, S. A. (1946), *Vit. and Horm.*, **4**, 337.

Thorn, G. W., Jones, B. F., Lewis, R. A., Mitchell, E. R., and Koepf, G. F. (1942), *Am. J. Physiol.*, **137**, 606.

Tipton, S. R. (1944), *Endocrin.*, **34**, 181.

Todd, W. R., Barnes, J. M., and Cunningham, L. (1947), *Arch. Biochem.*, **13**, 261.

Uotila, U. U. (1939), *Endocrin.*, **25**, 608.

Vazquez-Lopez, E. (1948), *Nature*, **162**, 458.

Venning, E. H., and Browne, J. S. L. (1940), *Endocrin.*, **27**, 707.

Idem (1947*a*), *Commun. XVII Internat. Physiol. Congress Oxford*, 167.

Idem (1947*b*); *J. clin. Endocrin.*, **7**, 79.

Idem, Hoffmann, M. M., and Browne, J. S. L. (1944), *Endocrin.*, **35**, 49.

Idem and Kazmin, V. (1946), *ibid.*, **39**, 131.

Idem and Bell, J. C. (1946), *ibid.*, **38**, 79.

Vogt, M. (1943*a*), *J. Physiol.*, **102**, 239.

Idem (1943*b*), *ibid.*, **102**, 341.

Idem (1945), *ibid.*, **104**, 60.

Wegria, R., Rojas, A. G., and Wiggers, R. (1943), *Am. J. Physiol.*, **138**, 212.

Wells, B. B., and Chapman, A. (1940), *Proc. Staff Meetings Mayo Clin.*, **15**, 493.

Winkler, A. W., Smith, P. K., and Hoff, H. E. (1942), *J. clin. Invest.*, **21**, 419.

Wislocki, G. (1938), *The Pituitary Gland.* New York.

Wolfe, J. K., Fieser, L. F., and Friedgood, H. B. (1941), *J. Am. Chem. Soc.*, **63**, 582.

Yates, F. (1937), *The Design and Analysis of Factorial Experiments.* Harpenden.

Zarrow, M. (1942), *Proc. Soc. exp. Biol. Med.*, **50**, 135.

THE TASKS OF PSYCHIATRY.

Presidential Address to the Section of Psychiatry of the Royal Society of Medicine, Tuesday, 12 October, 1948.

By J. R. Rees, M.D.

It is perhaps of some small interest that the President of the Section of Neurology delivered last week in this building an address on "The Borders of Neurology," and that for to-night I had chosen to speak on what is obviously a related topic, the "Tasks of Psychiatry." It is, of course, possible that behind this choice of our titles there may simply be a geriatric problem, for the President of the Section of Neurology and I worked together as members of the same Field Ambulance in the Battle of the Somme, just over 32 years ago. On the other hand, there may be more than this in it, and perhaps we really do need to define our fields rather more clearly and to make sure what our tasks are, and how we are best to meet them. In fact, I think that the question of the actual borders of psychiatry, as apart from its tasks, was dealt with quite convincingly in the Joint Report of the Royal College of Physicians, the B.M.A. Psychological Medicine Group and the Royal Medico-Psychological Association. There, in the section on the future organization of the psychiatric services, it says:

> "Where psychiatry begins and ends has not been settled. With the development of preventive medicine, its borders will become less rather than more definite. The study and treatment of delinquency, for example, has given psychiatry an active share in criminology, and the existence of the maladjusted and the poorly endowed child is the obvious but not the only reason why education is as closely linked with psychiatry as psychology is with both. It is true that no branch of medicine has sharply defined boundaries. The surgeon may encroach on the physician's sphere; the public health expert has to concern himself with engineering and housing. But psychiatry has less definite boundaries and marches with more non-medical territories than any of these. It follows that psychiatry must make even fuller provision for liaison than other branches of medicine, though its problem in this respect is fundamentally the same as theirs."

It is, I think, good for us to accept the fact that our borders will become less rather than more defined, that we are responsible for something which has such wide significance to the whole of our profession, and that indeed psychiatry is as Dr. Strauss said many years ago, "the other half of medicine."

In that same report of the Royal College of Physicians there is another statement worth remembering; that "psychiatry is a specialty or not a specialty in much the same way fundamentally as surgery and medicine are."

I imagine that in this room to-day there are few, if any, who would disagree with the concept of our necessity for liaison with non-medical groups ; and we should certainly find agreement amongst the majority of our colleagues in the United States. On the other hand, many psychiatrists in other countries would take considerable exception to such a statement, and I have recently had brought to my notice how strong the opposition is at times to the concept of working on equal terms with men and women from other professions which are concerned in various aspects of the mental health field. Is this the result of having had less experience than we have had of work, let us say, with the teams of child guidance units, where psychologists and social workers play so important and real a part, or is it something more fundamental ? Are we in psychiatry, and generally in medicine, somewhat unduly conscious of our status ? Is there some echo in this feeling of a deeper insecurity, or is it a reasoned and thought-out policy designed to protect the interests of the patient ? I suspect myself that there is a mixture of motives, but I am prepared to defend the policy of team work with non-medical colleagues against all comers !

Many of us have recently been concerned with the encouragement of inter-professional groups, " multi-disciplined," as the Americans like to call them, meeting to try and clarify their thinking about various problems of mental health. In this country, in America, in France, in Holland—to mention only a few of the countries—I have been made aware of doubt in the minds of some psychiatrists about the wisdom of such intimate collaboration. The fear has been expressed that psychiatry will suffer if it does not definitely play the dominating role or take the lead in all such activities, and from one of these countries I recently saw a lengthy manifesto calling attention to the inherent dangers in the popularization of psychiatric ideas and technique, and the risks of departure from scientific method in applying knowledge of the sick to those who are " healthy," and our experience of individuals to the study of groups.

Possibly the answer to the problem lies in our acceptance of two main divisions of our interest ; that in treatment and that in prophylaxis. Even such a differentiation cannot, however, be absolute, for in both diagnosis and therapy we most of us work very closely with our colleagues who are not medically qualified.

It may perhaps help us if we see how the various specialized jobs within the specialty of psychiatry divide up under the different headings.

Our friends in France, who are responsible for organizing the first International Congress of Psychiatry, which is to be held in 1950, have divided their subject matter under various headings :

General Psychopathology.
Clinical Psychiatry.
Psychiatric Anatomy and Physiology.
Biological Therapy in Psychiatry.
Psychotherapy, Psychoanalysis and Psychosomatic Medicine.
Social Psychiatry.

When I saw these large groupings of psychiatric interests it set me thinking, and I began putting down what seemed to be the main interests or specialties within the field of psychiatry. The list which follows may not be all-inclusive.

1. *Teaching.*

We should obviously think first of teaching as a task of psychiatry, and Prof. Lewis, when he occupied this Chair, gave us a brilliant address on the whole question of psychiatric education, with which I think we all agreed. It is certainly clear that if the best work is to be done in any of the specialties within psychiatry, then there must be a sound and all-round basic education in our subject, following, we hope, on very much better undergraduate education in psychiatry.

In considering every one of the tasks with which psychiatry may be faced I am taking it for granted that this question of an improved basic education, such as is coming about now, is one of the essentials.

In speaking of teaching as a specialized task of psychiatry, I think we should recognize that either the same, or sometimes different people, have to be responsible for the teaching of many groups, other than medical men. The clinical psychologists, psychiatric social workers and sociologists will need an increasing amount of psychiatric time spent with them in the course of their training. There are many lay groups—magistrates, probation officers, children's officers and children's workers generally, Ministry of Labour officials and others—who play a very important part in the preventive work for mental health, and they all need well thought out and well arranged training in the understanding of human beings which can best be supplied by psychiatrists.

In the United States there are considerable groups of people who seem to have accepted the absolute necessity of employing lay psychotherapists, and consequently they have the obligation to train them. Insofar as we find that becoming necessary here in the future, our psychiatric teachers will find themselves asked to take on a great deal of additional work.

2. *Treatment.*

Under this general heading there clearly are many tasks which are very different and which demand a good deal of specialized experience and training. We can list these as:

(*a*) The work of diagnosis and treatment in out-patient departments, and general consulting work in psychiatry.

(*b*) Treatment and care of psychotic patients who have to be hospitalized. Though there is not necessarily any very sharp division there seem to be two separate specialties here—that concerned with physical treatment and that concerned with psychological and social methods of treatment. If we assume that many of our hospitalized patients are to be treated analytically, following perhaps the experiments that are now being made in America, then it looks as though rather special people with special training would be needed for this, and they are not very likely to be those who are most interested in the physical and psycho-surgical methods.

(*c*) Mental deficiency or the specialized problems of subnormality.

(*d*) The treatment, generally non-institutional, of the psychoneuroses by psychoanalysis or by other methods of psychotherapy. In this specialty one can, I think, safely include responsibility for group therapy.

(*e*) Child psychiatry : It seems increasingly evident that with the growth of our knowledge in this field and the development of the various techniques of child analysis and social therapy, the child psychiatrist will become more and more a specialist in his own right. Child psychiatry is so important and so hopeful from the community angle that it certainly deserves to have all the encouragement one can possibly give it to become a definite specialty with its own careful methods of training.

(*f*) Forensic psychiatry and the care of psychopaths. It seems clear that a great deal of specialized training and experience is necessary in dealing with these problems, which cannot necessarily be handled very effectively by those with a general training in psychiatry. There are, I think, arguments both for and against the complete separation of the treatment of delinquency outside institutions, from other out-patient work. There are certain advantages from the point of view of the other patients, in a clinic that deals with neuroses, if the delinquent is not handled there. There is, however, a certain advantage to the delinquents if they are under treatment in a clinic along with those who are thought of as being sick rather than bad. On the whole my personal feeling is rather in favour of the latter course. None the less, there is a necessity for specialized experience in this field if effective work is to be done.

(*g*) Psychosomatic medicine is perhaps hardly a specialty, yet perhaps it should be listed. My own hope is that much of the work of the out-patient psychiatrist will, in years to come, be done by general physicians, and indeed by general practitioners ; and particularly is this the case with the so-called psychosomatic disorders. None the less, there will be scope for many years for much specialized work in research into and the treatment of these conditions.

I am not quite sure whether geriatric psychiatry is or will be a specialty or a sub-specialty. It seems to me that it is likely to come within the province of the psychiatrists who are primarily interested in institutional care, though the men who undertake such work particularly will probably be those who have a special feeling for it—which not everyone will have.

3. *Psychiatric Administration.*

This perhaps concerns a small group, but in my opinion it should be regarded as a specialty, and should be something that is carried out only by those who have aptitude for it and who have worked to develop their skills. It should not be either a prize or a dumping ground.

4. *Research.*

Under this heading there are three main groups of research which demand different training and background, and probably a different personality make-up in the workers.

(*a*) Physiological, anatomical and biochemical research.

(*b*) Psychopathological research (which probably fits in with 2(*d*) above—treatment of psychoneuroses).

(*c*) Statistical research, which is very near, of course, to the tasks of public health and social medicine.

5. *Service Psychiatry.*

In one sense this is a special branch of our profession, because it lies somewhere between the therapeutic and the preventive groupings, including much of both. Service psychiatry is likely always to use special techniques, and as with work in industry, it demands a very intimate knowledge of the social and working conditions of the men and women for whom it is responsible.

6. *Preventive Psychiatry.*

In the past, this work for the maintenance of mental health has tended to be regarded rather as a part-time occupation or hobby of those who were busily occupied in other branches of psychiatry, and not as a separate professional task needing particular experience and specialized knowledge. There are a good many indications that this idea has been changing of recent years, because the field of mental health work includes social psychiatry and all that comes within the field of human relations, in so far as the psychiatrist is concerned with these. The work of psychiatrists in industry will become increasingly important as they bring a dynamic point of view and their medical training and skills into the complex industrial field. Something much more than the devising of selection techniques is needed, for the problems of industry seem very largely to be brought about by group tensions and the development of situations which can best be understood and clarified in terms of dynamic psychiatry.

Similar problems arise in schools, in communities, in connection with public affairs and government agencies ; indeed, in the whole field of what the Americans call social issues there is a growing demand for psychiatrists to play their part with colleagues from other disciplines. This is work for which comparatively little has been done so far in the way of training.

The field of public education involves the addition of much experience of the use of the spoken and written word, and the techniques of the film, theatre, broadcasting and other methods of mass education. If mental hygiene in the past has at times over-sold itself, and at other times been ineffective, it is surely largely because we as psychiatrists have not taken the matter sufficiently seriously and gone into it with a genuine scientific approach and an enthusiasm comparable to that which we feel for much of our work with individual patients.

The education of lay groups, which I referred to earlier, is certainly a part of the work of preventive psychiatry. Marriage guidance and the education, direction and encouragement of similar agencies, fall into this same field.

Finally, the last and most neglected of our tasks in this field is that of concerning ourselves with the diagnosis and the giving of such advice as we can, in the widest field of group tensions, which is the field of international relations. We have felt ourselves ignorant—and in that we were certainly right. We have, however, less excuse perhaps than most people for evading these problems, because by our training and our experience we do know more about human beings and the way they work than any other group of men and women in modern society.

May I quote two sentences from an unpublished paper by Prof. Adolf Meyer :

> " We have to be able to be at peace among the different cultures and religions without sacrificing what is differently cherished and worshipped. . . ."
>
> " How the necessarily private and personal minds can become harmoniously minded is one of the studies within psychiatry and in all the search and research of the sciences that work together on and for man. . . ."

Here, indeed, therefore, is a formidable list of tasks which for the most part deserve the name of specialties within psychiatry. Many of them demand quite different types of personality. Interest in human relations and in neuro-anatomy may very likely not go together. The man who is specially expert at the physical methods of treating psychoses may contribute little to research in psychopathology and have little interest in the complex relationships of management and workers in industry. Each of them needs, however, a similar basic training ; and to me a most pleasing prospect in the new D.P.M. curriculum has always been the fourth and fifth years, which are to be devoted to specialization of some kind chosen by the individual. It seems to me that this wise suggestion is exactly what we need, because by that time the budding psychiatrist should have sufficient maturity to be moderately sure where he can be most useful and most happy, and he can set about getting his special training, if we can provide it for him.

It seems to me that we do need a great many people to be something more than " general purposes psychiatrists." Sir Lionel Whitby in his recent Presidential Address to the British Medical Association (though I am sorry to say he never even mentioned the word " psychiatry ") quite obviously assumed that in every branch of medicine specialism and sub-specialism was essential. This, indeed, was part of the changing face of medicine. He says : " Gone are the days of the individual general surgeon. Almost all surgeons are specialists in a limited field."

I think that probably the same applies in psychiatry, and it should be possible to incorporate this concept of increased specialism into the work of the National Health Service. One would certainly hope that before long studies will be made in each Region of the exact needs of the population and of all the special interests and skills that are available to meet these needs in the psychiatric field. The Health Service, in removing the profit motive from medicine, removes a main difficulty in arranging the transfer of any particular patient to the doctor who is best able to help him, and it should be possible to ensure that any psychiatrist who has particular interest and training for some special task should be able to be used to the best advantage within the Region.

I imagine that we shall see a certain partial specialization in the different psychiatric units throughout the Regions. Except for the particular purposes of teaching I suggest that we do not want to aim at general purpose units, for we should certainly be dissipating our skills if we did that.

If we accept our very wide responsibilities both within medicine and in our liaison with colleagues in the social sciences, we shall certainly make psychiatry more effective, more worth while and more attractive, so that the problem of bringing in some of the best of the men and women from the medical schools to psychiatric service may be simplified.

In looking back through the records of meetings of this Section in the last two years, if one excludes the joint meetings that we have held, we find that those meetings which were especially on psychopathology or psychotherapy have been slightly more popular than the others. There is not any great difference in the figures of attendances, and it is not a matter that we should in any way stress. The same fact emerged, however, in going through the forms which all Army psychiatrists completed before their demobilization after the recent war, when asked what branch of psychiatry they were most interested to follow up. Psychotherapeutic work with neurotics and what was vaguely called "social psychiatry" were the most popular choices (66 per cent. of the total). There, again, there were many misleading factors. It was not a typical sample and the conditions under which these men and women had been working in the Army obviously predisposed them to these choices. It is none the less encouraging that so many people in these days are interested in these varied tasks of psychiatry, since it means that those who are working in mental hospitals and who we hope are going to be able to put in part time on other work outside their hospitals should be able to get training and the opportunity for following up their particular bent. It looks as though there should be no shortage of people for these difficult and rather more abstract tasks. I personally have no fear that psychiatrists, by and large, will be content to work only in their institutions and to rely on the more formal methods of therapy, valuable as these are.

I suggest to you that it might be no bad thing if all of us were to consider what our own particular interests are, to make a list of our priorities, and then be prepared to let these be known to the Regional Psychiatric Committees and the other bodies who are surveying and planning for the development of our work.

I have a feeling of doubt about the educational facilities that we can provide for some people who want to and who should specialize in some of these directions within psychiatry. Since we shall have to work with sociologists, cultural anthropologists and others as well as with psychologists in many of these fields, it would be well to bring them in on our training programmes and on our planning at a very early stage.

The provision of special training is an important matter, because it is clear that even psychiatrists, like other people, prefer to deal with clear-cut topics in the understanding of which they are trained, rather than with the vaguer and more difficult subjects, such as are presented by the question of group tensions and international relations—to take the most extreme example. This was illustrated in the recent Mental Health Congress, where there was a marked difference between the demand for the specialized meetings on psychosomatic medicine for which the R.M.P.A. made itself responsible, and the more difficult problems of Nazi mentality and of displaced children which were the topics for the two meetings arranged by this Section.

Of course, it may be that people are weary with their constant anxieties about war problems and are therefore inclined to the relative security of discussing specialized techniques, but I suspect it is just as much due to the fact that we have had comparatively little opportunity of learning about the psychiatric contribution to such problems, that there is this apparent tendency in psychiatric interests.

When we first began to try and organize inter-professional discussion groups to discuss mental health and world citizenship, there was in this country and still more in the United States, great resistance to doing anything about it. People wanted a concrete and specific topic and became considerably anxious when they were asked to sit down and start tackling a vast subject which had —deliberately—been left vague. In fact, as you know, a very great many of these groups did get down to it. They very quickly began to find that not only could they do much better work because they were inter-professional, but that they could quickly isolate some particular aspect of the topic which interested them and which they were competent to deal with, and as a result of this a great many of these groups are, without any encouragement at all from the centre, continuing in being, because they feel they have found something worth while and some method of utilizing their special skills in a valuable way.

The international groups which met just before the Congress and during it had a very similar experience, and incidentally, demonstrated the great value of the method of free group discussion for the resolution of tensions and anxieties.

I wonder if in this country we take ourselves too much for granted, or whether it might be worth, in some modified way, following the example of the United States. There there is a body called the Group for the Advancement of Psychiatry. Some 150 members of the American Psychiatric Association, half of them ex-service psychiatrists, and including quite a number of the older men as well as the younger ones, have for the past two years been meeting very regularly and working on a number of committees, in which they have dealt with almost every aspect of psychiatric theory and practice. I understand that some people in this country who have come across their work regard them as potentially dangerous ! My own experience of the Group is that it is an extremely alive and stimulating body, which has provided a post-post-graduate experience for its members, which has clarified and pulled together a great many concepts which were very difficult, both on the clinical and the organizational side of psychiatry. It certainly is a group which has developed a tremendous momentum of its own, and I should guess that its effect on American psychiatry will be for good. It seems quite possible that our Regional groups of psychiatrists might do something, in our less intense British fashion, which will be comparable to this. I would expect that if such a movement were to be encouraged by us, a number of quite surprisingly useful and interesting developments would result from it and that we should do something to make our psychiatric services more effective.

May I remind you, by the way, that our French colleagues have asked this Section to have discussion groups on the various topics which have been selected for the 1950 Conference ? That is a matter upon which I think the Council of the Section will be very glad to have any suggestions or any offers.

I am asking a lot of questions, because I really do not know the answers ;

and I have a further one—as to whether in fact we should carry out our various tasks more effectively, and have a greater sense of unity and strength, if we had something like a Faculty or a Royal College of Psychiatry to further the development of our training and our work.

If we believe that our training and our day-to-day experience of human beings gives us a special position in regard to mental health, then we must, I think, be prepared to take leadership and be somewhat active in this field. Who is to try to solve the apparently insoluble problems in the field of international tensions at the present moment ? Admittedly, no one of us by ourselves can do anything very startling to heal these breaches. None of us, so far as I know, has yet been called in by any of the sick nations who are involved. Yet I wonder if we could not have something to say about matters like the recent Breslau Conference. About this, one prominent man of science who attended wrote to the press evidently regarding it only as a tragic instance of political manoeuvring on the part of one country against the other. Another wrote pointing out that a very great deal of useful catharsis had occurred, and that it was a good thing to get aggression out as openly as it did come out at that conference of intellectuals. He said that at the end of the conference he felt that there was quite a degree of better understanding between the East and the West.

Surely this is something about which we, as psychiatrists, should have an opinion. Some of us could repeat the experiment probably if we were to interest ourselves in some of the local political groups. Perhaps we should not have to go further than some of the committees or the local staff Councils, in which there are often considerable tensions. Is the helpful abreaction of an individual's anxiety and aggression comparable to the abreaction or catharsis of a group ? Does it in the latter case have a similar effect ?

Those of us who are interested in social psychiatry and who may be working in hospitals can, without leaving our hospitals, probably institute investigations of considerable importance. We not only need these days a careful social survey of the national health service and how it works, but we need surveys of our individual hospitals for the study of doctor-patient and nurse-patient relationships, the way in which the whole group functions, and matters of this sort. There have been very few studies of the kind published. I suggest that the field is well worth exploration, and that valuable experience could be gained. We should certainly increase our own personal understanding of the psycho-sociological factors at work ; we might find ourselves solving the nursing problem and also speeding up our recovery rates.

Amongst many problems that came up recently in our attempt to study international communication and the art of conferring with other people, I was interested that from a number of sources there came a demand for the use of some kind of symbolism or some method of utilizing emotion for the achievement of the purposes of the group. They raised the issue of how far one can employ in a planned manner any kind of emotional appeal for what I suppose could be called therapeutic ends. As one person said : " We pay much attention to the conscious and the rational and leave the deeper and irrational, of which we talk so much, to pick up such crumbs and crusts here and there as they can."

In the past people have wondered whether a democratic country could provide any emotional appeal or drive at all comparable to that which the Nazis achieved for their own ends through the Hitler Youth Movement and the other special organizations. The U.S.S.R. seems in some ways to have found a similar method of approach and an emotional appeal which we in the democracies do not always have. We all tend to fear the appeal to emotion, or signs and slogans which are so easily captured for unworthy or dangerous ends. Is there, despite these dangers, some way in which we can and should utilize the symbolic and emotional appeal ? It is a very difficult and, it seems to me, a very important point on which we ought to be thinking.

I will not read you the actual letters ; some of them would strike you, as they did me, as extremely comic at first sight, with their suggestion of songs and tunes and processions or of the use of symbols of various kinds. None of them were acted on, I am afraid, because of uncertainty, and I fancy that none of us are sure enough of our ground in this matter. It was interesting that some time ago, in discussing conferences, Dr. Margaret Mead said something rather similar to me when she pointed out that any large conference would be more successful if it had music, flags and flowers.

I must come back from this topic to place two or three more specific problems before you. Someone may already have done some work on this subject, but I have read nothing whatever about the emotional aspects of the country's obsession with football pools. Possibly some of you have that obsession yourselves ! A well-known London journalist, when talking to me a short time ago, rather startled me by saying that football pools are now the national substitute for religion. Since as a nation we have very largely given up the idea of a magical God who will look after us and provide us eventually with a heaven and all the appropriate fittings, people must find something else for themselves. Some twelve to fourteen millions (I am not sure of the number) of our fellow citizens apparently send in pool coupons every week. This journalist's description of the situation was that the only three days these people came alive at all were on Monday morning when the papers arrived from the pool organizers, on Wednesdays when the form had to be filled in, and at 5.30 on Saturday evening, when the results came through. The lure of the chance that they might be the winner of the big prize was what kept them going in an otherwise dull and purposeless world.

If in fact this is true, and it seems as if it well might be, then we certainly are challenged as therapists, because it can hardly be regarded as anything but a psychological or a character disorder on the mass scale. As individual therapists we are most of us constantly concerned with seeing that our patients find something that makes life worth living, some kind of philosophy for themselves. It ought not to be beyond our wit, in conjunction with other people to discover some answer to a problem of this type, if further careful investigation showed that it did indeed exist in this form and to this extent.

I wonder how many people here are regarding it as one of their tasks to be thinking about the questions of service psychiatry in case of another war. We have a good deal of experience, at first hand or indirectly, which should enable us to lay plans and make suggestions that will be of value not merely to the Services but to civil defence. We ought to be able to plan in advance for the maintenance of the morale of the country faced by biological or atomic war. We ought to be thinking out what the national attitudes will be, because though we all hope war will not occur, we certainly should not be quite unprepared for it.

This is a very practical and a very pressing task that we as psychiatrists should undertake. It is not something that can usefully be left to other people to think about.

In the Hospital Regions it seems to me that these matters might very well be ventilated at the same time that we are considering the allocation and distribution of various tasks as they emerge in our own areas. In the recent war pure scientists, for almost the first time, became practical contributors to all kinds of projects designed to help win the war. In every branch of medicine clinicians turned their attention to preventive measures with great success. One might quote the neuro-surgeons' painstaking work on the despatch rider's helmet ; the ophthalmologists' work on gun sights ; and the neurologists' work on the internal design of tanks. We as psychiatrists did our fair share in all the Services. We have been going from crisis to crisis in this country since 1929, and we still find ourselves in that state. There still is the need, and a fairly urgent need, for our interest to be turning on to problems other than the purely clinical ones, and most of us have a contribution to make here.

Finally, there is one task of psychiatry about which much is said. I heard about it throughout the war, and I have heard a good deal about it since the war ; that we should "integrate psychiatry with general medicine." I believe myself that this is an unreal statement ; it is most often made by those who have little comprehension of psychiatry and have had little contact with it. Sometimes clearly it is said by those who really believe that psychiatry is just very simple common sense and should be received back, like a prodigal, by General Medicine and Public Health. If one may transpose the statement, I would say that the need for general medicine to integrate itself with psychiatry seems to me very much greater. But it certainly is one of our tasks to improve our contacts, to learn from and to give what help we can to our colleagues in every other branch of medicine. We should have a very proper respect for ourselves as physicians and as people who are specially concerned with human behaviour, and so stimulate everyone who is going into medicine and everyone who is practising it at the present time to a greater interest in all the manifold problems which are fundamentally psychiatric.

We have, indeed, many tasks, and they are at least as difficult and responsible as those which fall to the lot of any professional group. That is why it is satisfactory to be a psychiatrist, for we shall certainly see our work becoming increasingly interesting and bearing fruit for the good of humanity and for the honour of medicine.

THE LONG-TERM RESULTS OF INJURIES OF THE HEAD. (A MEDICAL, ECONOMICAL AND SOCIOLOGICAL SURVEY.)*

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In 1939 an inquiry was begun into the late results of the type of head injury which results from collisions on the roads, from accidents in industry and from falls in the home. Since penetrating injuries resulting from civilian accidents are extremely rare, the examples that were encountered have been eliminated from the final reckonings and so the following account is concerned entirely with the so-called closed type of injury. It must, of course, be realized that compounding and infection are common even in this type of injury, because cranial fractures frequently run across and open into the paranasal air sinuses.

The inquiry was designed to give the following information :

1. The time elapsing before a man was able to return to work.
2. The financial cost to the country on account of lost man-power hours and of the expense of hospital treatment.
3. The percentage occurrence of post-traumatic epilepsy.
4. The nature of the residual illness and in what way this illness prevented the man from living a normal life and how it affected the happiness of his family and dependents.
5. Whether a man after head injury became more sensitive to the effects of alcohol, so that smaller quantities rendered him incapable of driving a motor car safely.

A man's emotional and intellectual changes are neither easily recordable nor precisely measurable and, therefore, a simple factual answer of the questions set out above is not possible. By the nature of the problem some conclusions must be influenced by the variable factor of the observer's methods and by his sociological beliefs. None the less, the symptoms must be discussed and given the prominence and stress that their importance seems to merit.

METHOD.

The logical way of carrying out a survey of the long-term results of head injuries would be to assess sequelae at the end of the patient's life. As this method was impracticable it was decided that the best thing to do was to consider only those patients who had received injuries to the head during or before the year 1935 ; that is at least five years before the start of the inquiry. A questionnaire was drafted with simple questions so that the patients would be able to convey the required information with the least effort on their part and so throw light on the matter set out in the section above. Prof. John Morley very kindly put the facilities of the Research Laboratory at my disposal. Mrs. Kenneth Watkins also gave me invaluable aid in collecting and recording the data. The in-patient notes

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of the head-injured from the year 1935 backwards until a series of 1,000 had been amassed were obtained. This series was obtained almost entirely from the records of the Manchester Royal Infirmary and the Salford Royal Hospital. Access to the records of outside hospitals was very kindly and freely given to us when necessary.

After a series of a thousand consecutive hospital records had been studied, a questionnaire and a return stamped envelope was sent to each patient concerned. In spite of second letters and appeals to the police to help in tracing patients, 430 replies only were received. The poor response was probably due partly to indolence, partly to the fact that townspeople are constantly changing their addresses and largely to the abnormal conditions of war-time. That all the patients were not traceable is an obvious weakness in the survey. However, as the limits of possible statistical errors are obvious I believe that information of medical and sociological value can be derived from the figures obtained.

For various reasons I thought it necessary personally to question and examine 93 of these cases. Of these, 60 were willing to travel; their expenses were paid and full examination was made in the day-room at the Manchester Royal Infirmary. The other 33 who were unable to travel were visited by myself in their homes and these visits took me as far afield as Blackburn, Bury, Bolton and Preston. Many whole days were spent in searching out these people, but my trouble was well rewarded because it was in the home that I got the deepest insight into the late results of head injuries.

Length of Time from the Date of Accident to the Patient's First Return to Work.

Of the 430 cases, 122 were either housewives, children or people for various reasons not gainfully employed. The remaining 308 cases who were so occupied have been grouped according to the number of months that elapsed from the date of accident to the day they first returned to work. In each group a sub-grouping has also been made on the basis of the length of time each patient was unconscious, as this gives a measure of the physical cerebral damage inflicted at the time of injury.

(*a*) Patients without loss of consciousness.
(*b*) ,, unconscious for half a day.
(*c*) ,, ,, over one day.
(*d*) ,, ,, over one week.

Time Off Work (months).

	1.	2.	3.	3–6.	6–12	12 months or more.
(*a*)	5	7	10	10	2	5
(*b*)	29	30	17	18	5	5
(*c*)	13	16	22	14	16	4
(*d*)	5	4	9	16	9	8
Total	52	57	58	58	32	22

Number of Cases Completely Incapacitated.

(*a*)	4
(*b*)	9
(*c*)	10
(*d*)	6
Total	29

Number of Cases Fit for Normal Life (Children, Housewives, Retired and Unemployed).

(*a*)	42
(*b*)	33
(*c*)	30
(*d*)	17
Total	122

During an acute illness and during convalescence a man is not only idle economically, but costs much work to other people and expense to the country through hospitalization. Moreover, a man commonly breaks down after a period of work and is away again ill for varying periods of time. To trace a patient's working time from the date of injury continuously over a period of five years or more is beyond the scope of this survey. In the 308 cases it will be seen that 29 people did not work again up to the time of this survey, which means that many had been permanently incapacitated for any kind of work. Of these 29 completely incapacitated cases 4 had received injuries to their heads which, from the physical point of view, must be regarded as trivial. These patients were found to be suffering from severe degrees of psychoneurosis of the anxiety type.

Even in the group of the non-gainfully occupied, many encountered indirect economic hardships. A mother's illness, for example, often necessitated her daughter's staying away from industry to carry on in the home. Child patients lost their schooling certainly for as long as they were ill, but even a few months from school often led to the child getting a whole year behind. In some cases a head injury led to complete cessation of the child's education because the parents thought it would be against the child's interests to let him continue with his studies. This occurred particularly in the duller type of child, for whom a more prolonged course of education than normal was indicated, and not a shorter period at school. Return to work in the majority of cases was made long before the patients had made a complete recovery from their symptoms, such as headaches and insomnia. Furthermore, many patients had not returned to their original employment, but were engaged in so-called light and sympathetic duties. In the whole group the economic loss, both to the family and to the state, was very great.

Incidence of Post-traumatic Epilepsy.

From the questionnaire it was found that numerous cases were complaining of fits and fainting and dizzy attacks, but from the patient's own description of these it was obvious in many cases that the attacks were not epileptic in nature. In 48 cases only was the diagnosis of epilepsy regarded as a possibility. With one exception these were interviewed and examined by myself either at the Manchester Royal Infirmary or in the patients' own homes. The untraced case was classified as non-epileptic.

From the interview it became clear that many of the attacks complained of were vertiginous or in the nature of a sensation of blackness before the eyes. After critical consideration of each case I came to the conclusion that 11, and only 11, cases could be regarded as suffering from epilepsy. In every case where the diagnosis of epilepsy was made it was ascertained from the patient himself and from an observer that there had been a period of unconsciousness during an attack.

This brings us to the problem of what is meant by the term "post-traumatic epilepsy," and it is a very difficult one. Strictly speaking, what is meant is, in a brain where there is not an inherited tendency to epilepsy an injury produces such physical changes that the neurones on occasions discharge their energies dysrhythmically to cause neural dysfunction. If this definition were rigidly adhered to very few cases of epilepsy following closed head injuries could be classified as being post-traumatic in origin. Focal epilepsy, which we would expect to follow trauma, is exceedingly rare. It must be realized, however, that the physics of head injuries are such that contusions of the motor cortex are rare, and this possibly explains why focal epilepsy is rare. Contusions of the undersurfaces of the frontal lobes and temporal poles of the brain, on the other hand, are common; this may explain why *grand mal* is the common type of epilepsy resulting from head injury.

Every brain, by means of suitable stimuli, can be set into a state of active epilepsy; therefore, theoretically, in every human brain there is an inherited predisposition to epilepsy. Within most brains, however, there is what might be termed an anti-epileptic reserve, so that under the normal conditions of living and within reasonable physical and emotional stresses epilepsy does not occur. Under certain conditions an injury will destroy this reserve, or in other words precipitate an inherited tendency. At what point a tendency can become precipitated into activity cannot be known. Whether a patient who develops epilepsy following a head injury would or would not have developed epilepsy under normal stresses of living cannot be known. It is obvious that in some cases where an inherited tendency is great, epilepsy can be precipitated by a less severe degree of injury than in others where the inherited predisposition is small. Before I classified any of the following cases of epilepsy as post-traumatic I made sure, as far as was possible, that the patient did receive an injury to his head of sufficient magnitude to produce physical changes and that before the accident there was no history of epilepsy or infantile convulsions. By neurological examination it is impossible in most cases to determine the presence or the exact nature of damage that results from closed injuries of the brain. Indeed, large meningo-cerebral scars may exist without clinical signs.

The economic consequences of epilepsy in every case are considerable. For example, a man is precluded from driving a motor car for at least two or three years and often for his life. The results in each case are conditioned by the frequency and severity of the attacks; by the type of man suffering from them and by the type of work the man has to do. In the worst of my cases a man was having so many severe attacks that he had become completely disheartened and was unemployable. On the other hand, one of my patients had three major convulsive seizures in the first year following the injury and then no more for six years. I finally traced this man to his work, where I found him on a high scaffolding. The penalties of epilepsy are greater than they need be because of the reluctance of private employers to give work to an epileptic lest he should damage himself and make a claim for compensation. (This is a weakness in our community which merits further inquiry and correction.)

In the final review of this series of 430 cases of head injury there were 11 cases of epilepsy. Histories of these cases are appended.

The Residual Illness.

The assessment of disability resulting from obvious physical defects, such as unilateral blindness, deafness or hemiplegia, can be made with reasonable accuracy. On the other hand it is extremely difficult to determine how much a man is disabled by headaches or by dizziness because our judgment on these matters must depend on the man's own words, on how much his illness affects his behaviour, and on the statement of his relatives, and such indirect measurements must necessarily lack precision. The main complaints of the 430 patients themselves in this series were of headaches, dizziness and insomnia. It is difficult to assess the significance of these when trying to determine how severely a man is incapacitated.

However, the problem of the residual illness was found more complex than the assessment of severity and incapacitating effects of symptoms, such as headaches, because from the answers to the questionnaire and from personal questionings it was obvious that the symptoms of which the patients mainly complained could not satisfactorily account for so much prolonged inability to return to work and for so much delay in resuming normal and happy living.

It is very doubtful whether a cerebral injury ever does or can, in fact, produce a psychosis. On the other hand, it is firmly believed that a psychosis can be precipitated by a head injury in a predisposed person. Neither of these contentions, of course, can be proved or disproved.

That mental deterioration can be produced by cerebral injury, by destruction of sufficient neurones, is obvious. Permanent and severe grades of dementia, however, following closed head injury of the diffuse neuronal type are very rare indeed; there was one instance only in the 430 cases under consideration. Whether a finer grade of mental reduction is a common occurrence is uncertain. Elsewhere I have stated that I believe that intellectual impairment following head injury is rare. After my experiences in this review I am inclined to modify my views on this important subject. In none of the cases of the present series were formal intelligence tests carried out. The reasons for this were that such testing had not been envisaged when this survey was planned, and that on previous occasions I had discovered that the head-injured co-operated so unwillingly as to vitiate the value of such measurements. I had, therefore, to depend for my judgments of possible intellectual impairments on (i) impressions gained during conversations with patients; (ii) the behaviour of patients during detailed neurological examinations; (iii) on the attitudes of patients towards litigation; (iv) on the way patients had readjusted themselves to their work and to their way of living; (v) on the views of near relatives; and (vi) on the comment of employers whenever such information was available. Apart from the one instance of dementia, I discovered that the ability to read, write and do simple arithmetic had not been destroyed; this, of course, does not mean that the desire to read, write or reckon had not been interfered with, and often it had. Patients had no difficulty in following simple logical arguments and most were capable of shrewd comments. Many were very slow in answering questions and few gave straightforward answers, even to simple questions. None the less, when their answers did come, the answers were sound. Many patients complained of faults in memory, but apart from the usual pre- and post-operative periods of amnesia, no gross faults could be detected in this mental faculty. What the patients meant was that they could not memorize new experiences, but this I believe was an indication merely of the loss of concentration rather than an absolute loss of the power of remembering. The impression in most cases was of mental slowness rather than of actual mental fault.

At this point it will be helpful to sketch the clinical picture commonly met with in the early stages of convalescence after a moderately severe closed head injury, and also to describe some experiences gained in a varied and extensive practice of litigation ensuing from head injuries.

Let us consider the hypothetical case of a middle-aged working man with a family who, ten years ago, received an injury to his head of the closed type, of such severity that he did not regain full consciousness until the third day. Probably he was kept in bed for another two or three weeks in hospital and then sent home to go to bed for another short period; then he would begin to get up and about. At this period it would be noticed that all was not going well; instead of trying to get better, the man would sit about the house all day with a fixed, miserable expression on his face; he would expect everything to be done for him and would have nothing to give in return; he would be entirely pre-occupied with his illness, irritable with his wife, intolerant of noise and peevish with his children. The thought of going back to work would scarcely enter his head. Moreover, he would believe that any kind of activity would be bad for him. He himself would complain of headaches, dizziness, insomnia, lack of interest, faults in memory and inability to concentrate.

Neurologically, apart from the mental attitude and general loco-motor sluggishness, there would be little else to detect wrong. Sense of smell or of hearing might be impaired and the deep reflexes might be very active. In simple terms, there would be little evidence of any gross lesion in any circumscribed region of the brain.

As the weeks went by the man's symptoms would improve by natural processes and, say, after two or three months a decision would have to be made regarding the man's fitness to return to work, what kind of work he would be capable of carrying out and at what period full recovery could be expected. It would be at this point that the problem of litigation would arise.

In most instances of litigation, I formed the opinion that my patients were well aware of the true consequences of the injury they had received, both to themselves and to their families. Nearly all the patients, even when they had received a severe injury, were well aware of the logic of even the most intricate financial arguments. Indeed, if a mistake was made to their detriment they quickly noticed it and wanted it corrected. On the other hand, patients often were most stupid about, and resistant to, advice which would, if followed, in the long run have been beneficial to them, even in the strictly financial sense. For example, a man would stick out for a few hundred pounds when, by the time he got it he must have lost two or three times as much in wages or in other ways. Often when pressed to accept a settlement, which is best in a long-term sense, a patient became antagonistic and would show his resentment by his unreasonable suspicion. In cases where it was obvious that the counsellor could have nothing but the interest of his patients at heart he was often told that he would talk differently if the accident had happened to him, implying that his advice was not, after all, totally disinterested, which, in fact, it was.

Even after the closest scrutiny and fortified with the awareness of the possibility, I rarely came to the conclusion that a man was a frank malingerer. This conclusion I know cannot be proved, because the English way of thought precludes any secret investigations or spying into the way an injured man lives and reacts in his private life. On the other hand, I was often convinced that a man was exaggerating his symptoms in order to gain his end, and this end was as often an emotional as a monetary one. Indeed, it was often obvious that a man was fully enjoying the fuss and sympathy his family was giving him and had no intention of giving up easily what to him was a great and sometimes unprecedented luxury. Whilst in legal conference, and when a barrister was probing the weakness of his case it was rare that a head-injured litigant fell down before even the fiercest barrage of questions. For example, a man rarely had too little or too much to say; he rarely got angry or flushed when pressed and would often gain a point, by just the correct gesture or the correct facial expression. In the witness-box of the open court the head-injured litigant is notoriously an excellent witness. That a man is a good witness, it may be claimed, indicates the genuineness of his plea. On the other hand, I believe it also implies that his intelligence has not been seriously impaired.

The more one engages in litigation the more one is assailed with doubt in one's own mind. The doctor is always asking himself whether or not a litigant is grossly exaggerating his symptoms and whether he will not quickly recover once he is properly recompensed. In simple legal terms, is the golden ointment curative? What does a man do with the money of a lump sum settlement? Does a man ever recover completely from a severe closed head injury and what is the nature of his final disability, if any?

Let us return to the consideration of the long term review, and see amongst other things if these questions can be answered satisfactorily. Immediately following are set out in detail the records of five patients chosen to illustrate what are thought to be the dominant features that characterize the residual illness.

Negativism.

A young man, (Mr. B—), aged 29, was traced to a house in Bolton, Lancashire. On arriving there I found that he had changed his address. Fortunately it was known that he worked at the depot of a provision store. On interviewing the foreman there he told me that Mr. B— did, in fact, work for him, but for some reason or other, which he had forgotten, the man was not at work that morning. From the foreman's words and attitude it was obvious that he regarded Mr. B— as a man of little consequence. He gave me my patient's new address. I knocked at the front door, which was slightly ajar, and getting no answer I pushed it slowly open and walked into the lobby and looked through an open door on the right, which opened into the sitting-room. Here was a coffin supported on two trestles, draped with a Union Jack and covered with flowers. Standing on the far side arranging the flowers was a young woman in tears. I apologized for coming at such an inopportune moment, but on telling her my mission she told me that she was Mrs. B— and that her husband was in the kitchen, beckoning with a shake of her head. On entering the kitchen I saw a young man sitting at the kitchen table in his shirt-sleeves. He did not rise on my entering, he did not ask who I was and just said, "How do?" He was eating a piece of fried meat, drinking tea, and smoking; the fire in the kitchen grate was big, the room was hot and the wireless was blurting out some syncopated melody. I turned off the wireless and then I asked him who it was in the next room. "Oh," he said, "that is my father—he died the other day." I asked him if he would miss him. "I think I will," he said. I asked him about the arrangements for the funeral and he said his wife was doing all that. He was obviously unaware of the emotional tension in the house; his attitude was just crude. On being asked about his accident he said it was a bad one. Asked about his job, he said his employers were good to him and let him stay away whenever he was not up to it, which was fairly often. Physically he was a good specimen. Neurologically there was nothing abnormal to be found. He was quite willing to strip naked and walk about the kitchen. On simple examination there was no suggestion of frank intellectual defect. He could read and talk fluently. He could quickly work out simple sums and talk rationally and logically. He was, in fact, quite a decent and sensible type of man to talk to. He complained of occasional headaches and dizziness, and of fainting attacks, but it was obvious that none of these were seriously incapacitating him. We left on very friendly terms and he sat down to resume his meal, which he had placed on the hob to keep warm during my examination.

Next, I went to see his wife, and nodding towards the kitchen I gave the impression that I thought him a "rum sort of chap." It was obvious, at once, by the wife's expression that she thought differently. To her it was a tragedy. "That is not the man I married," she said. "I wouldn't have had a man like that." I mentioned that they looked comfortably off and she said that was due to help from her husband's parents and from the compensation her husband had received, which was somewhere between two and three thousand pounds. On being pressed to say how her husband was different, she had great difficulty in explaining. He was selfish, but not in a cruel way; just in a crude sort of way. He was without interest, without affection and without a sense of deep responsibility, either to his home or to his work; he was lazy and he expected a lot from other people, but gave nothing himself; he rarely spoke constructively and left to himself would obviously have become dirty and untidy. His wife's reactions to him consisted of a mixture of pity, loyalty and revulsion. Intellectually, the wife was well above the average.

The man was not so much indifferent to his wife's feelings as unaware of them. At times he was peevish and rude, but never violent. He never raved or shouted; indeed, his wife said she wished at times he would. He was more like a vegetable than an animal. Before his injury he was a good type of man. His father had a little business, including a shop and he was to have taken this over in the near future. He had become a passenger both from the economic and family point of view. His wife had taken over the responsibility of looking after him in every way. Moreover, an economic descent was soon inevitable, but this was not going to worry him. The man had virtually entered a negative state. His injury had occurred six years previously and had been so severe that he had not gained consciousness till some time in the third week.

Laziness.

Mr. C— was a man aged 45. Before his accident, which occurred several years ago, he had been a casual labourer. He had often been out of work because of unemployment, but was always keen to accept work when it was available. I was able to discover from a council authority that his working record had been good and that the man himself had been regarded as a good workman. He was injured while working on the road by a passing motor-car. The man was rendered unconscious immediately at the time of the accident and was removed by ambulance to the neighbouring hospital, where he was admitted as an in-patient and detained for three weeks. He was in semi-coma for 12 hours. The skull was fractured, but there were no serious injuries elsewhere in the body. When I first saw him five years later he told me he had not done a day's work since his accident and had never even tried to do so. He stated quite frankly that he believed that his accident had incapacitated him permanently even for the lightest form of employment. He had, in fact, refused all offers of light employment. He lived partly on his weekly compensation and partly on the Public Assistance Committee, and intended to do this for the rest of his life. He was a man of a slight, wiry build.

Neurologically I could not detect a single abnormal sign. Intellectually I could not demonstrate any frank impairment and his wife thought that there was nothing wrong mentally. On the other hand, the man himself stated he was quite incapable of thinking clearly. He complained of loss of concentration, faults in memory, dizziness, headaches and irritability. However, none of his own complaints prevented him going out each day to the park, to his club and to the public house. He was quite generous to his wife financially and was quite interesting when recounting what he had been doing during the day. I came to the conclusion that this man was perfectly capable of carrying out a reasonable day's hard work; indeed, it was my conviction that the man's disability was laziness. I made it clear to the man that it was my belief that he was lazy. This opinion did not anger him; he merely smiled and answered that he wished me no ill, but if by chance I did meet with a similar accident to my head I would change my opinion about him.

Emotional Lability.

Mr. J— received an injury to his head in 1932 which rendered him unconscious for 24 hours and confused for several days. He was detained in hospital for 2½ weeks. His skull had been fractured and as far as can be judged he had received an injury to his brain of medium severity of the diffuse neuronal type. On his return home he complained of headaches, dizziness and inability to sleep. Later he became aware of a sense of dizziness in himself that prevented him from concentrating on a single job for more than a few minutes at a time. Then he began to complain of faults in memory and of loss of interest. This information was forthcoming from his wife, who was a particularly intelligent woman.

Three months after his injury he returned to his work which was of a clerical nature. The office staff was kind to him and gave him a warm and sympathetic welcome. Soon he was able to carry out his full duties, but was under an enormous strain the whole time. Occasionally, for no special reason, he would burst into tears to the embarrassment of the rest of the office staff. He was extremely sensitive to any remark that was made about him. The silliest and most trivial joke might cause him to laugh inordinately. At home his behaviour was even more unbalanced than when at his work. One hour he would be whistling and singing about the house and the next he would be weeping and moaning about his future. He was irritable, but not actually bad tempered. The man stated that everything seemed to affect him emotionally one way or the other. On the whole he was unhappy. He himself was well aware of his own emotional lability and it upset him very much. His wife's reaction was that of anxiety. Before his accident her husband was normal in every way. Now she felt that he had become emotionally unsound. There was no deterioration of his work at the office. Neurologically, apart from a general increase in the deep reflexes, there were no abnormal physical signs detectable.

Unhappiness.

This account concerns a man, aged 45, who was injured five years ago, when he received an injury to his brain that rendered him unconscious for 1½ days.

Before the accident he was a draper by trade. He started in a small shop in a back street, but by dint of careful working he had soon established a flourishing business in the main street. He was, his doctor told me, always the fussy little type of man, but always very courteous and very correct in his manner. If anything, he was little obsequious. On the other hand, he was a diligent worker, giving a great deal of care to the details of his business. Also, he was ambitious and hoped one day soon to open a second shop in another part of the town. He had married rather above his own social status, and for his wife's sake had set up an attractive house in the suburb. He was a man of poor physical build, but, on the other hand, was an ambitious man in a successful way, living an apparently happy and contented home life.

After his head injury he had completely changed. In the words of his wife and doctor he had become "transformed into a little dithering old man." Always small in stature, he had now become more stooped than ever. He had lost weight and in every way his general health had deteriorated. His complaints were of headaches, dizziness, lack of concentration, lack of interest, depression and insomnia.

When he first came to see me he was accompanied by his wife and by his general practitioner. He looked an intensely miserable little man. He walked slowly, having to be helped along. He was perspiring profusely and, in the vernacular, was "puffing and blowing." He was placed in a chair, his forehead wiped and given a drink before the performance of examination could begin. On being asked simple questions he appealed to others to answer for him; to get even simple information from him demanded a tedious effort on the part of the examiner. When asked to undress, both his wife and doctor stepped forward to undo his collar and boot laces. At this stage I sent his wife to another room and asked his doctor to sit still. On pressing the man to do something for himself he burst into tears and collapsed into his chair in a state of complete abjection. Having seen this I allowed his doctor to undress him. On being stripped, the man on request walked about the room trembling all over his body and when asked to stoop or rotate he made grotesque attempts to do so.

Neurologically, apart from hyperactive knee jerks there were no abnormal physical findings; the special senses were unimpaired. Intellectually the man was normal as judged by simple tests. He was aware of the devastating effect his illness was having on his business. He could read and write, carry out simple arithmetical problems and appeared to be well in contact with his environment. Though not at work, he was very worried about the welfare of his business, but felt unable to do anything about it. He had completely lost his nerve and was afraid of meeting, not only strangers, but his friends too. He was extremely worried when his wife went out and was always begging her to come back as soon as possible. He was always much better when he was alone in his house with his wife, and on those occasions when she had expressed no necessity of having to go out in the early future. The whole picture was pathetic; the man was profoundly unhappy.

Bad Temper.

A man, aged 47, received a serious injury and for many weeks afterwards behaved like a raging lunatic. Indeed he was so difficult to control that certification and transfer to a mental hospital were seriously considered. He was detained in a general hospital for 12 weeks. On his return home his temper was atrocious and for months his wife was afraid he would do her some violence. For little reason he would stand and shout and gesticulate as if he had gone mad. His complaints, in the early stages of his illness, were of headaches, giddiness and inability to think and sleep. Gradually his temper improved and his complaints became less strident, but he was always to be humoured and pacified. Anything happening to cross him would send him into a violent temper.

I first saw him eight years after his injury. I found him to be a broad-shouldered healthy-looking man, of powerful build. Before I had spoken to him he lurched suddenly forwards and glared at me in an aggressive sort of way. Then he sat back and snorted. He attitudinized and gesticulated. Before answering even a simple question he would cock his head and raise his eyebrows in a whimsical sort of expression. He rarely answered even a simple question in a straightforward way. His wife, however, had learned by experience that "his bark was worse than his bite." For years he had threatened her with violence, but had never actually struck her. The worst he had done was to shake her by the shoulders. In the early stages of convalescence the wife stated that her husband could not sleep and would roam noisily about the house in the middle of the night, knocking things over. She was of the opinion that her husband was not "mental" defective, but was "driven off his head" when his headaches or dizzy turns were bad. He had not worked since his accident, and as far as I could judge never would. This man was not frankly demented. Indeed, he attended cricket matches and had a good eye for form. He was quick enough to recognize any mistake that might be made to his disadvantage. All his arguments were logically sound.

On physical examination I could not find a single abnormal sign. Before his accident his intelligence was that of a normal working man, who had left school at the age of 14 years. There was little doubt that since his accident he was a changed man.

This is an extreme case, but it serves to illustrate that findings of irritability and peevishness tend, in some degree, to run through the majority of these cases.

Intellectual Deterioration.

This case concerns a man, aged 23. Before his accident he was training as a motor salesman and was a very keen motor-cyclist. Indeed it was when racing his motor-cycle five years previously that he had met with his injury. According to the evidence of his family he had before his accident been a normal energetic man; healthy both in body and mind. At the time of his accident his brain must have been very severely injured because he was deeply unconscious for a week and still confused at the end of a month. The questionnaire we sent had been filled in by his sister-in-law. On being asked to come to the infirmary for examination it was stated by his relations that he was incapable of travelling unaided and that no one on the farm could be spared to come over with him. Therefore, I made a personal visit to see him. It was in the afternoon when I arrived and found the address to be a small farmhouse. The man was living with his brother, who was farming in a small way.

I first met his sister-in-law, who took me into the kitchen at the back of the house, where her brother-in-law was sitting in a corner of the room. He took little notice of me; he just nodded when I said, "Good afternoon," to him, and continued to stare blankly in front of him. I asked his sister-in-law to leave him to me and to go on with her work in some other part of the house. The man had the greatest difficulty in answering the simplest of questions. He knew his name and where he lived, but he had difficulty in naming the day of the week and hadn't the slightest idea of the date of the month. He never spoke unless spoken to, and then usually answered with a muttered grunt. He was quite genuinely uninterested in my interest in him. He made no complaints and even on direct questioning only admitted having occasional headaches. Physically he was sparsely built, but healthy.

Neurologically I could find no abnormal physical signs. From his family I learned that he slept perfectly well and his appetite was good. His sister-in-law told me that since the accident he was in a state which was akin to hibernation. He made no complaints. He spent most of the day in the warm back-kitchen. Only occasionally would he feed the hens for her and then he would do it untidily. He never listened to the wireless, never read the paper and only spoke when spoken to. His habits were clean and he had given no trouble whatever. He seemed to be in a perpetual dream. His family's impression was that nothing was going on in his brain. For at least three years there had been no change in the man's condition. There was no insanity in the family; indeed the family stock was very good.

These six cases are, of course, extreme examples of the features they were chosen to portray. As can well be understood, all degrees of these characteristics from one extreme to the other occur. Not every feature, of course, appears in each case. The possible combinations of each feature in their differing degrees are manifold and so, therefore, are the possible clinical pictures.

It is from wives and near relatives that the best insight into the residual illness can be obtained. With very few exceptions, wives and mothers I interviewed stated frankly that whatever money their husbands or sons had received in litigation had in no way recompensed them for the way they themselves had suffered as a result in the changes of personality of their loved one. It was chiefly in the home that the effects of injury are felt. The man often loses his good temper, his tenderness, his sense of responsibility to his loved ones. Emotionally he expects far more than he can give.

Out of the 30 employers whom I interviewed, 25 told me that the change they had noticed in head-injured men was that they needed constant supervision. To some extent they had lost their initiative and sense of responsibility. Also, they seemed to have slowed up both mentally and physically.

In 50 instances detailed inquiries were made into what happened to the monies of lump-sum settlements. On the information given in this inquiry I can state firmly that even adequate compensation does not cure a traumatic cerebral illness. On the other hand, lump-sum settlement in the early convalescent stages often gets a man back to useful employment earlier than otherwise, because a man now feels that the onus is on him to readjust himself to the best of his curtailed ability. In other words, compensation clears up a patient's exaggeration, but not his true medical disability. To solicitors it therefore can be said that the "golden ointment" is not curative, but useful.

In four instances the monies of a lump-sum settlement were rapidly squandered in lavish generosity to relatives and friends and in the expenses of parties, racing and alcohol. In no instances were there any regrets by the man himself regarding the way the money had been spent.

In six instances attempts had been made to establish little businesses with something like success in two only. In these two successful cases it was the other party who had taken on the hard work and the responsibility of making decisions. The idea that a little business is easy to run if the initial financial outlay can be covered is a very erroneous one ; to make a small business pay demands hard work, sacrifice and long hours of personal attention.

Forty (80 per cent.) of the patients put their newly acquired wealth into safe investments. Medically, this is probably the least useful of all the ways of using the money, for the interest, in most cases, derived from the investment is so small as to make little difference to one's standard of living. As one man put it, the interest on his £2,500 scarcely paid his cigarette bill.

My advice would be for patients to spend their money freely in seeking good health, in holidays and in improvements in their houses and in other amenities of living.

From what has been said before, it is abundantly clear that persistent deteriorations in personality and in emotional stability are very common after injuries to the head. On the other hand, frank dementia is exceedingly rare. Few relatives are of the opinion that the injured have lost their wits. When approached regarding their financial affairs they are very quick to appreciate any decision or suggestion that affects their interests either disadvantageously or otherwise ; they are well aware that someone else is responsible for their disability.

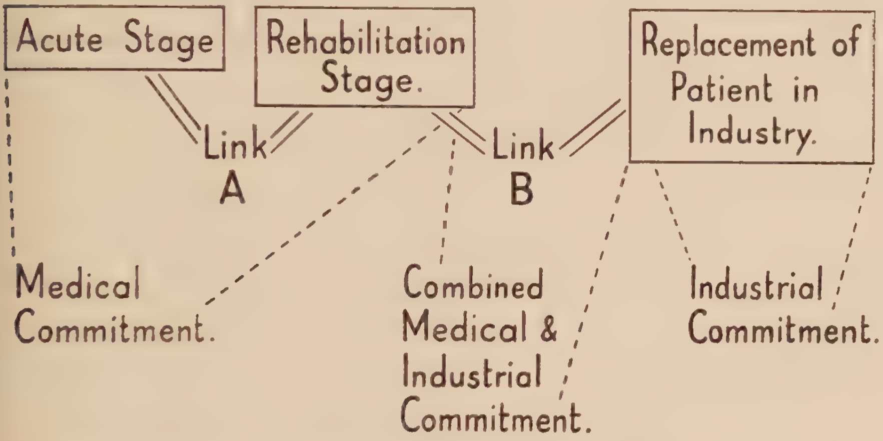
The physics of closed cerebral injury, sufficiently violent to render a patient unconscious, are such that all the neurones in the brain are subject to stresses and strains and, therefore, the residual illness may result from neuronal destruction or from alterations in the neuronal pattern. In other words the residual illness may in many cases have a physical basis.

On the other hand, it is well-known that minor injuries of the head, that could not have inflicted lasting physical damage to the brain, may produce persistent illnesses which are apparently indistinguishable from those produced by severe violences. It may be questioned whether severe or minor injuries do or do not produce illnesses which are absolutely identical. It is possible, of course, that they do not. However, by the clinical tests that are now available, it is impossible when examining a patient a long time after his injury to judge accurately whether or not he received a severe injury to his brain. Indeed, many patients who received no injury to the head of any kind may complain much of the same symptoms. However, even in minor traumata it must be remembered that the injury has been transmitted by the physical pathways of sight and hearing. Very rarely does a man break down because of the frightening thought of an imagined accident.

In comparing long-term results of different surveys an important criterion is the death-rate in the series concerned. In this series the patients were drawn from the types of injury where the death rate lies between 16–20 per cent. The majority of the cases in this series did not pass through skilled neurosurgical or neurological hands and were not formally rehabilitated ; they also returned to work when economic conditions were adverse and when there were far more workers for the job than there was work available.

Finally, let us consider what lessons can be learned from this survey and what can be done to mitigate the ill-effects, once the damage has been inflicted.

If the sequels of closed head injuries are to be minimized then it is obvious that the patients who receive this type of trauma will have to be treated adequately in the acute stages of their illness. To do this a sufficient number of surgeons will have to be specially trained. One of the weaknesses in the past has been that far too many patients have been under the care of surgeons who are not interested in the problem. The problem resolves itself into the phases depicted in the following diagram.



Medical rehabilitation consists of a system of graduated mental and physical exercises carried out under favourable conditions and under the guidance of a doctor who fully understands the underlying problem.

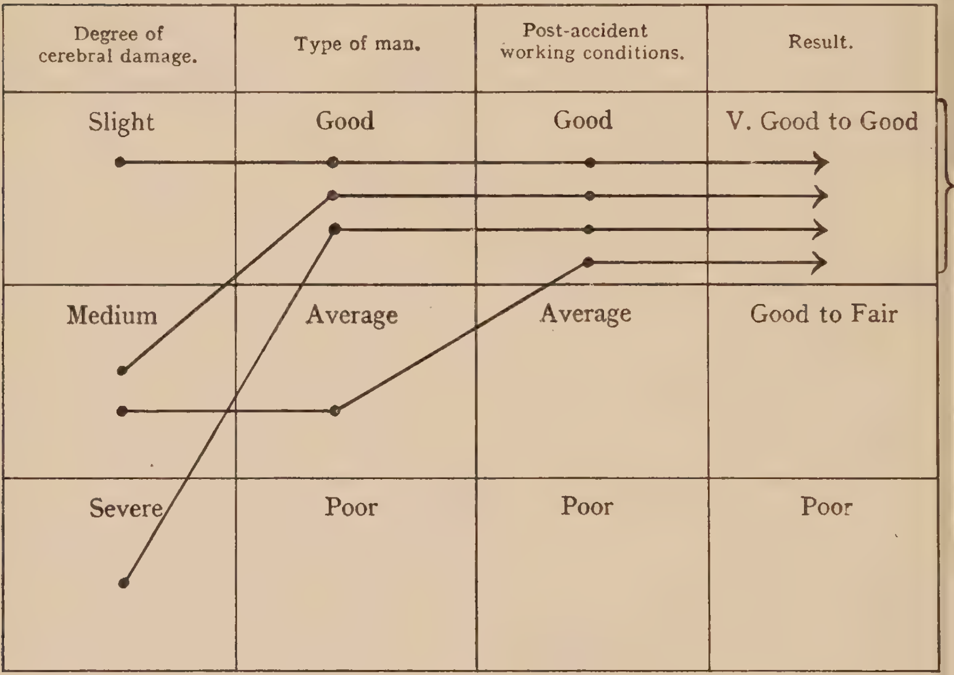
The link between the acute stage and the rehabilitation stage is an important one and there must be the closest co-operation between these two phases of treatment. Indeed, the doctor who is responsible for treatment in the acute stage must see his head-injured patient right through the medical rehabilitation stage until his patient returns to work. Rehabilitation and replacement in industry is being planned but, of course, its success to a large extent is governed by economic conditions. It is important that medical personnel in charge of the rehabilitation stage should go out into industry and make a study of the nature of the jobs that the men they have rehabilitated are supposed to go back to. Ample facilities are given in industry for this kind of observation and I myself have found it most interesting to visit the heavy industries of mining and of shipbuilding.

What I wish to speak about in particular is link B, the link between the medical phase of treatment and industrial replacement. Efforts are being made by the Government through the Ministry of Labour Offices to let the medical practitioner know what kind of work is available for the injured. It is true that the medical profession is being asked to fill in Ministry of Labour forms which will give detailed medical knowledge about patients who have been injured and who are seeking work. The medical and industrial liaison is still, in many cases, very unsatisfactory and this is largely a medical fault. Let us consider how this liaison can be improved. Let us assume that a group of patients has been adequately treated both in the acute stages and in the stages of medical rehabilitation and that link A is a satisfactory one ; in other words let us assume that there have been no medical faults up to the close of the rehabilitation stage. The patients that finally issue from the rehabilitation centre to be received in industry will be of different types and different grades of physical fitness and of mental intelligence. To understand this final complex it is necessary to review the factors which govern prognosis. These are three in number and are as follows :

(1) The nature of the injury.
(2) The type of man who was injured.
(3) The nature of the job to which the man must return after convalescence.

In the following tables a diagram is made to express in graphic form the influence each factor has on the final result of treatment.

TABLE I.

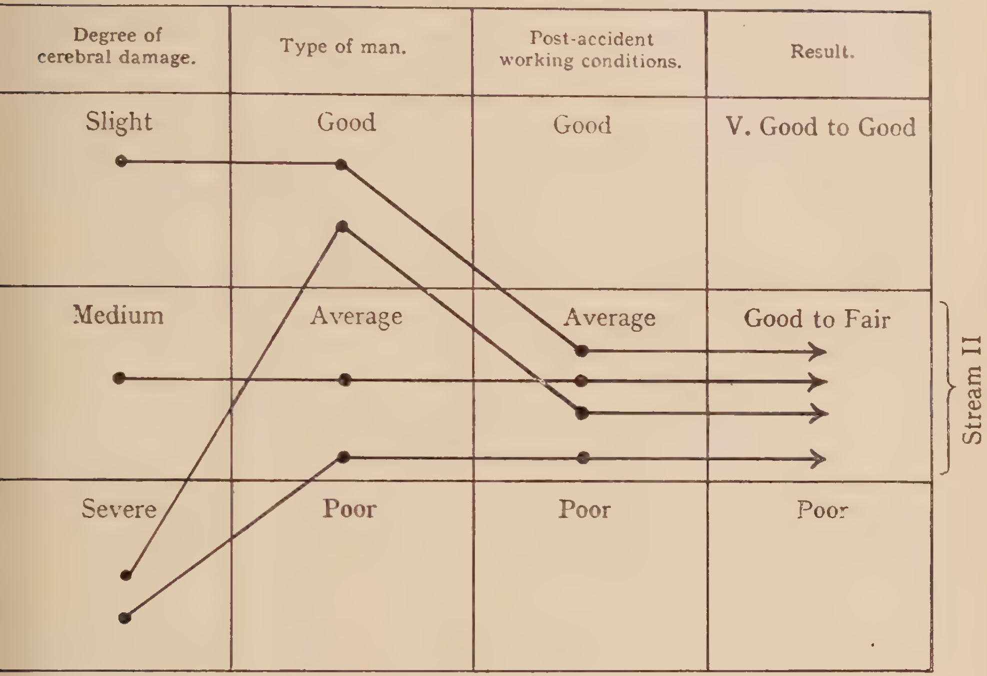


Degree of cerebral damage.	Type of man.	Post-accident working conditions.	Result.
Slight	Good	Good	V. Good to Good
Medium	Average	Average	Good to Fair
Severe	Poor	Poor	Poor

From the tables it will be seen that there are three streams issuing from the rehabilitation centre.

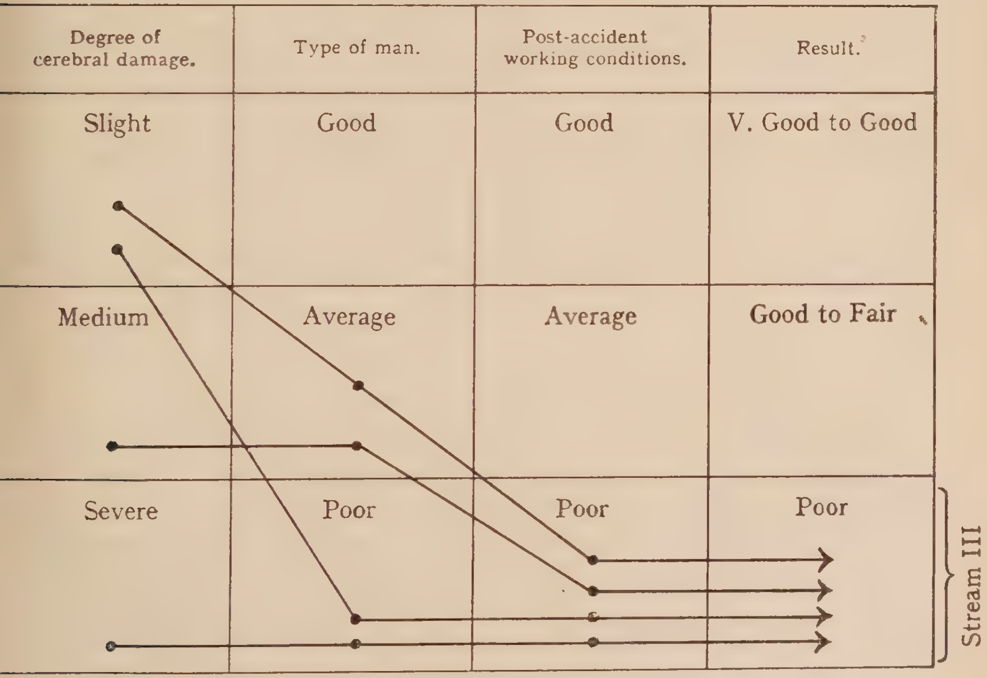
All that remains to be done is to make absloutely clear what the figures of this survey mean. The 430 patients' records concerned here are not from consecutive cases. Therefore, it is impossible to say that out of every 100 cases of head injury so many patients were left with headaches, giddiness or similar symptoms.

TABLE II.



Degree of cerebral damage.	Type of man.	Post-accident working conditions.	Result.
Slight	Good	Good	V. Good to Good
Medium	Average	Average	Good to Fair
Severe	Poor	Poor	Poor

TABLE III.



Degree of cerebral damage.	Type of man.	Post-accident working conditions.	Result.
Slight	Good	Good	V. Good to Good
Medium	Average	Average	Good to Fair
Severe	Poor	Poor	Poor

On the other hand, the 430 cases collected were fairly representative of head injuries, since the injured were of all ages, of both sexes, busy with all kinds of different occupations and had received cerebral injuries of differing magnitudes. The absolute number of people traceable in one area suffering from sequels to their head injury is in itself enough to give this subject importance apart from possible percentage occurrence. In any case, it was the lasting disturbance of the emotions which came clearly to light, and this discovery of the true nature of the residual illness in no way depends on mere percentage deductions. Regarding the percentage occurrence of epilepsy following head injury, all I have shown is that in my series it was 2½ per cent.

This figure, I believe, would be the same in a consecutive group of cases, because my cases were clearly representative of any head-injured group.

To Prof. Geoffrey Jefferson I am grateful for the generous use of his material and for his encouragement. Dr. Raymond Whitehead, of the Pathological Department of Manchester, has given me invaluable help in the preparation of this paper. I also thank my friend, Mrs. Kenneth Watkins, for all the hard work she did in the early stages. Finally, I would like to thank my secretaries, Miss Hilda Huddleston and Miss Norma Harvey, for their patient help.

CASE REPORTS

Name.—Harry B—.

Age at time of accident.—23 years.

Date of accident.—1934.

How accident occurred.—Motor-cycle.

Severity of accident.—Unconscious 6 hours; in hospital for several weeks; off work 4 months; fractured skull.

Time from accident to first fit.—Two months later.

Nature of first fit.—Without warning he dropped unconscious into a generalized convulsive seizure, but recovered in half an hour or so.

Frequency of fits.—They have occurred on and off at irregular intervals since, and he was discharged from the services on account of major epilepsy.

Other complaints.—Headaches, dizziness and changes in disposition.

Examination.—He was a man of slow mentality and obviously very concerned about his physical health. Neurologically no abnormality was found to point to any residual focus of organic damage in his brain. The special senses and cardiovascular system were normal.

Capacity to work.—He is able to work under sympathetic conditions as a packer doing light work at the Co-operative Wholesale Society.

Remarks.—The epilepsy in this case was not the main sequel. The main disability was his personal changes and severe headaches.

Name.—Norman P—.

Age at the time of the accident.—15 months.

Date of accident.—1930.

How accident occurred.—Fell off table on to back of head.

Severity of accident.—Unconscious for 15 minutes; in hospital for 7 days; no fracture of the skull.

Time from accident to first fit.—A few hours.

Nature of first fit.—In the first fit the child suddenly went unconscious; there were no convulsions.

Frequency of fits.—After the first attack the child had numerous seizures and, as far as I can judge, at least once a week. These slowly became less frequent, ultimately occurring at monthly intervals. He now goes for as long as six to eight months without a seizure. His mother states that for no reason he will suddenly become still, stare vacantly in front of him and obviously lose consciousness for a few moments. He has never fallen, but his mother thinks he would do so if there was not someone there during an attack to help him down into a chair. On no occasion has he been convulsed and his mother states that his limbs do not become stiff.

Other complaints.—He has no other complaints.

Examination.—He is a boy of good average, intelligence and the following is a final report from his schoolmaster: "Norman P— has been taught by me over the past year, and I report that from what I have seen of his work and conduct he is an average boy. A keen scholar, he enjoys games and is well mannered. He is clean and a regular attender."

Capacity to work.—This boy is still at school and is doing satisfactorily.

Remarks.—There is no history of epilepsy in this family. On the other hand, it is very likely that there was a distinct tendency to epilepsy in this case. There was a definite injury to the head and it was shortly after this that the first epileptic seizure occurred. There is no doubt here that we are dealing with a true case of epilepsy and we shall have to regard the injury as being, at least, a precipitating factor. It is doubtful whether these are major or minor epileptic attacks.

Name.—Frederick S—.

Age at time of accident.—47 years.

Date of accident.—1931.

How accident occurred.—A fall from a ladder.

Severity of accident.—Unconscious 3 weeks; In hospital for 17 months; has not worked since accident; fractured base of skull.

Time from accident to first fit.—7 months.

Nature of first fit.—He suddenly jumped up, grabbed his wife by the shoulders; his mouth was drawn over to the left side, and then he fell unconscious to the ground twitching all over his body and frothing at the mouth. It took about 20 minutes for him to recover consciousness. In this first attack he was incontinent and also bit his tongue.

Frequency of fits.—Too numerous to enumerate.

Other complaints.—Headaches, dizziness, insomnia, and bad temper.

Examination.—On examination he was a man of slow mentality, facetious and aggressive. He was also emotional and unstable; at one moment he would laugh and the next he would weep. His gait was firm; co-ordination of movement tremulous and his general balance was unsatisfactory in rotation and in stooping. Hearing was impaired on the left side. Sense of taste was present, but sense of smell was dulled. The cardiovascular system was normal.

Capacity to work.—He has not worked since the accident, and apart from his epileptic seizures is completely incapacitated and probably will remain so for the rest of his life.

Remarks.—A true case of post-traumatic epilepsy. There are other disabilities besides his epileptic seizures.

Name.—William S. W—.

Age at time of accident.—18 years.

Date of accident.—1934.

How accident occurred.—Fell off motor-cycle.

Severity of accident.—Unconscious for a week; in hospital for two months; off work for five months; fractured skull.

Time from accident to first fit.—2 weeks.

Nature of first fit.—One day during his convalescence, when sitting up in bed and talking to his father he fell back unconscious but did not, as far as we can ascertain, twitch or become stiff in the limbs.

Frequency of fits.—Has had many attacks since then and was discharged from the services after full investigations as suffering from *petit mal*. In many of these attacks he loses consciousness for a few moments only and remains standing in his tracks. He does not fall and does not convulse.

Other complaints.—No other complaints apart from a feeling of anxiety as a result of his discharge from the services.

Examination.—He is a man of good intelligence, but obviously is highly strung and now worried about his present illness. His gait is firm; co-ordination of movement is a little tremulous and general balance is satisfactory in rotation and stooping. Hearing is impaired on the left side. The other special senses are normal. There are no positive pyramidal signs and no sensory loss. The cardiovascular system is normal.

Capacity to work.—He is now training to be an architect and intends to carry on with his work.

Remarks.—We shall have to accept this as a case of *petit mal.* Moreover, this boy did receive a severe injury to his head, and there is no doubt that this injury was accidental and not due to a seizure.

Name.—Clifford W—.

Age at time of accident.—23 years.

Date of accident.—1934.

How accident occurred.—Motor-cycle.

Severity of accident.—Unconscious for three weeks; in hospital for two months; off work for 13 months; fractured skull.

Time from accident to first fit.—3 or 4 years later.

Nature of first fit.—Whilst at work as a cinema operator, without warning he fell to the floor unconscious and according to an observer he had a convulsive seizure. In an hour or so he had completely recovered and was able to go home.

Frequency of fits.—He had another attack, similar in character to the first, two years later. Since then he has had peculiar attacks in which he becomes confused for a few moments and is unable to carry on with his train of thought. In these attacks he does not lose consciousness and does not fall.

Other complaints.—He is a man of good average intelligence and is in no way unduly emotional His gait is firm; co-ordination of movement smooth and general balance satisfactory. There is slight deafness in the right ear and a complaint of tinnitus in the same ear. The sense of taste is good, but the sense of smell is impaired. There are no pyramidal signs, no sensory loss and no inco-ordination of movement. The cardiovascular system is normal.

Capacity to work.—For the last few years he has been working regularly as a plumber and on many occasions has ascended scaffoldings and worked for long periods at a height.

Remarks.—This man received a severe injury to his head and there is no doubt that this is a true case of post-traumatic epilepsy which is of the major type. This man almost certainly has got a meningo-cerebral scar, but it is impossible to demonstrate its presence by simple clinical means.

Name.—Bessie G—.

Age at time of accident.—4 years.

Date of accident.—1931.

How accident occurred.—Knocked down by motor-cycle.

Severity of accident.—Unconscious for three days; in hospital for three weeks; fractured skull.

Time from accident to first fit.—2 years.

Nature of first fit.—In the first attack she felt sick and experienced a peculiar feeling in the stomach and then remembers no more. Her mother was told that she had dropped down in a faint and remained unconscious. There was no history of convulsions. After this first attack she was very well apart from repeated nose bleedings. At the age of 13 years the attacks changed a little in character. Each seizure was preceded by a state of mental confusion in which she would say and do queer things and then she would sit and become absolutely vacant, staring in front of her. Her mother states that on some of the occasions she would certainly have fallen had she not been there to help her sit down in a chair. There has been no history of incontinence.

Frequency of fits.—There have been six attacks in which she has lost consciousness and fallen. There have been numerous occasions on which she has lost her thoughts for a few seconds, but has not fallen.

Other complaints.—There are no other complaints, such as headaches or dizziness.

Examination.—On examination she was a girl of average intelligence and though perhaps a little highly strung was not unduly emotional. Her gait was firm; co-ordination smooth and general balance satisfactory. All the special senses were normal. There were no abnormal neurological signs.

Capacity to work.—At the age of 14 this girl lost her first job in a chemist's shop because of one of her fainting attacks. She is now working as a machinist and is granted concessions by her employers who understand her illness.

Remarks.—This girl shows no residual signs whatsoever of her head injury. Moreover, the classification of her epileptic seizures is difficult. It is difficult to know whether to regard them as major or minor epilepsy. The attacks are undoubtedly epileptic.

Name.—Frederick B—.

Age at time of accident.—56 years.

Date of accident.—1932.

How accident occurred.—Motor car.

Severity of accident.—Unconscious for two hours; in hospital for six weeks; off work for eight months; fractured base of skull.

Time of accident to first fit.—Several years later.

Nature of first fit.—Without warning he fell back off his chair on to the floor in a convulsive seizure.

Frequency of fit.—He had several less severe attacks in the following few months, but has had none over the past few years.

Other complaints.—None.

Examination.—A man of good intelligence and of good physique for his years. There is no evidence of past injury and no evidence of any metabolic disease.

Capacity to work.—He is doing a full-time job as a plumber, including climbing up on to a scaffolding.

Remarks.—He is an excellent type of man. He is undoubtedly suffering from epilepsy, probably as a result of the accident.

Name.—Reginald R—.

Age at time of accident.—27 years.

Date of accident.—1930.

How accident occurred.—Motor-cycle.

Severity of accident.—Unconscious for 14 days; in hospital for 7–8 weeks; has not worked since accident; fractured base of skull.

Time from accident to first fit.—Within a year.

Nature of first fit.—He was found unconscious in a field. The man remembers nothing at all about the first attack.

Frequency of fits.—Frequent attacks of major convulsive seizures over irregular periods of time. He has no warning and falls heavily into a state of generalized convulsions.

Other complaints.—Headaches, dizziness and general nervousness.

Examination.—He was a poor type of man mentally. Physically there was no evidence to point to a discrete focal lesion of organic damage in his brain. The special senses were normal and the cardiovascular system was normal.

Capacity for work.—He has not worked since the accident and probably will remain completely incapacitated for the rest of his life.

Remarks.—A true case of epilepsy preceded by a severe injury to the head and presumably, therefore, the epilepsy is traumatic in origin.

Name.—Arthur D—.

Age at time of accident.—21 years.

Date of accident.—1931.

How accident occurred.—Motor-cycle.

Severity of accident.—Unconscious for 10 days; in hospital for a month; off work for 18 months; fractured skull.

Time from accident to first fit.—5 years 9 months later.

Nature of first fit.—This was a generalized convulsive seizure not preceded by a warning.

Frequency of fits.—Frequent convulsive seizures without warning and most of the attacks occur in bed.

Other complaints.—Headaches and dizziness.

Examination.—He is a man of good average intelligence and in no way unduly emotional. There is no evidence of any residual organic damage in his brain. The cardiovascular system is normal.

Capacity to work.—He is working full-time as a gardener.

Remarks.—He is a good type of man who received a severe injury to his head and almost certainly his epilepsy is due to the trauma.

Name.—Fred S—.

Age at time of accident.—38 years.

Date of accident.—1933.

How accident occurred.—Fall.

Severity of accident.—Unconscious for 36 hours ; in hospital for four weeks ; off work for six months ; fractured skull.

Time from accident to first fit.—18 months later.

Nature of first fit.—On the first occasion after uttering a scream, which he does not remember, he fell down into a convulsive seizure.

Frequency of fits.—Since the first seizure there have been repeated attacks coming on at intervals as short as 14 days or as long as 6 months. Apart from a peculiar feeling in the stomach there is no warning of the onset of a fit.

Other complaints.—Headaches, dizziness and nervousness.

Examination.—He is a man of average intelligence, but very highly strung and worried about his present state of health. There were no abnormal neurological signs to point to any residual damage in the brain. The cardiovascular system was normal and there was no sign of disease in any of the other metabolic systems.

Remarks.—This is an undoubted case of major epilepsy and probably due to the head injury.

Capacity to work.—He had been discharged from work on many occasions on account of the epileptic seizures.

Name.—Harold W—.

Age at time of accident.—21 years.

Date of accident.—1930.

How accident occurred.—Motor accident.

Severity of accident.—Unconscious for 7 days ; in hospital for 14 days ; off work for 10 months ; no fracture of skull.

Time from accident to first fit.—15 weeks later.

Nature of first fit.—First of all he felt a peculiar feeling in the left temple which radiated down the arm into the trunk and as the pain developed he dropped unconscious.

Frequency of the fits.—On many occasions he has experienced an aura of pain spreading over the left side of the body, but only on very few occasions has he lost consciousness.

Other complaints.—Headaches, irritability and general nervousness.

Examination.—He is a man of fair intelligence, but obviously very worried about his present state of health and what the future is going to show. Neurologically there is nothing to point to any residual organic damage in the brain. The cardiovascular system is normal.

Capacity to work.—Apparently he is greatly incapacitated and can only carry out light employment under sympathetic conditions.

Remark.—This is almost certainly a true case of post-traumatic epilepsy, though he is a poor type of man and his personality changes are more disabling than the epileptic seizures.

THE PSYCHOSOMATIC DISEASES: A HYPOTHETICAL FORMULATION.

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I. What is a Psychosomatic Disease?

We need no longer dally over theories of the mind-body relationship; we need not even speak of the integration of body and mind, for that integration is not just the combining of parts to form a whole; the unity of any organism has existed from its first beginnings, evolutionary or individual. Myers (13) and Russell (18), by introducing a concept of "the directiveness of organic activities," have defined this essential and intrinsic unity even more cogently than the many other exponents of the same theme. The unicellular amoeba, at one end of the evolutionary ladder, has all the biological capacities of man at the other end. The fertilized ovum develops from within itself all the specialized parts and functions of the higher animals. The unity, then, has been there from the beginning. The complexity of man is not an integration, but is a delegation of functions. As Russell says, the directiveness and creativeness of mind are but a specialized development of the directiveness and creativeness inherent in all living matter.

Similarly, any illness is a unitary reaction of the organism as a whole. On the other hand, the causes of any illness—even the simplest—are multiple or cumulative stresses which finally break down the organism's powers of adaptation or of compensation. Such views upon the multiplicity of the causes of disease and upon the unitary constitution and reaction of the organism are basic to any theory of knowledge in medicine and psychiatry. Such views are the essence of Adolf Meyer's general principles of psychobiology which have influenced psychiatry for many years now. What, then, is new in the term "psychosomatic"?

We may seek a definition from Weiss and English (22), who describe three groups of psychosomatic problems. Group I: Sick people who are not "out of their minds," and yet who do not have any definite bodily disease to account for their illness—the so-called purely "functional" problems of medical practice. Group II: Patients whose symptoms are in part dependent upon emotional factors even though organic disease—maybe serious organic disease—is present. Group III: A group of disorders generally considered to be wholly within the realm of "physical disease," which have to do with the vegetative nervous system, such as migraine, asthma and essential hypertension. They think there may also be a fourth group in which psychological disturbances may lead to structural alterations. Weiss and English clearly distinguish these three or four groups and the distinction should be maintained. Although mind and body are one we must not lose sight of the trees for the wood, and there are great differences between the groups of problems listed. If the term psychosomatic medicine is to have a new and specific meaning it should be in relation to the illnesses of the third group. These are all conditions which were formerly regarded as purely physical in origin, but in which many now think emotional and physical factors act together in a peculiarly intimate relationship. Most of them lead in time to structural alterations, and they have other features in common which I shall endeavour to analyse.

A tentative list of the psychosomatic diseases may be offered as follows: The paroxysmal rhinorrhoeas; bronchial asthma; gastric and duodenal ulcer; ulcerative colitis; essential hypertension; arterial degeneration, including coronary artery disease, if occurring before the senile age-period; hyperthyroidism; migraine; chronic arthritis; certain skin diseases, especially urticaria and pruritus; enuresis; and primary dysmenorrhoea.

The choice of conditions in the list must be justified, as the rest of the paper is an attempt at systematization based upon the features of the disorders listed—not that there are any rigid systems in Nature, but our knowledge has to be based on systems which allow us to isolate and to classify natural phenomena and thus to attempt to understand them.

More purely functional states which may apparently present largely with bodily symptoms are excluded, for example, effort syndrome, anorexia nervosa and impotence. Mucous colitis and pseudocyesis are excluded as belonging, more doubtfully, to the same category.

Enuresis is included because Stalker and Band (19) claim that it is not purely emotional in origin but has important somatic components. The symptoms are diurnal as well as nocturnal, and are reflections of an uninhibited type of neurogenic bladder, such as is found in subtotal lesions of the higher levels of the central nervous system. The disorder has its roots in the usual bladder state of infancy, and it may represent a delay in neurophysiological maturation. It is very occasionally found in persons who appear normal psychiatrically. It responds better to treatment with ephedrine than to any psychotherapy. Michaels and Secunda (12) found that enuresis with behaviour disorders was significantly associated with electroencephalographic abnormality.

Possibly more important is the exclusion of states which others might wish to include, but for which the evidence seems insufficient—for example, achalasia of the cardia, diabetes mellitus, paroxysmal tachycardia, and Ménière's disease. However, if one included such diseases, most would, on analysis, show the same features as the original list.

The conditions named in the tentative list have one essential common quality which distinguishes them from other bodily diseases, such as pneumonia or cancer. The major symptom or disturbance of function in each corresponds to some known bodily form of emotional expression, for example, the diarrhoea of ulcerative colitis; the raised blood pressure of hypertension; and the general autonomic disturbance, so like that of fear, in hyperthyroidism. This is what Weiss and English meant by saying that they all had to do with the vegetative nervous system. (Arterial degeneration does not have this quality, so far as is known, but its other general features make it fairly generally accepted as a psychosomatic disease, *cp.* Flanders Dunbar (5) on the anginal syndrome and on coronary occlusion.)

Yet the bodily manifestations of emotion in these diseases are very different from the bodily manifestations of emotion in the neuroses. To understand this matter we must consider the general subject of the bodily effects of emotion.

II. Can the Bodily Effects of the Emotions be Classified?

Many different emotions, such as elation, depression, fear and rage, can be recognized by subjective introspection or by observation of others. How much the emotions differ in their bodily expressions is uncertain. Many now think that the bodily expressions of emotion can be classified in a few simple groups. Thus Cannon (1) stressed the utilitarian nature of the bodily effects of emotion. He said that the cranial autonomic system is concerned with the quiet service of building up reserves against times of stress, and that these functions are accompanied by the relatively mild pleasures of the sight and taste and smell of food. The sacral autonomic is concerned with sexual functions. All these parasympathetic functions are inhibited when the sympathetic division is excited. Cannon claimed that all the "exciting" emotions, especially fear and rage, and also states of pain and asphyxia, show themselves in activity of the sympathetic—including increased output of adrenaline, increased blood sugar, increased action of the heart and lungs, decreased muscular fatigue, and transfer of blood from the abdominal viscera to the heart and the voluntary muscles. These he regarded as primitive responses occurring with the rapidity of a reflex, and designed to mobilize bodily energy to meet a situation of danger with either fight or flight. He believed that other emotions, such as joy, sorrow, grief or disgust, could have the same sympathetic effects when they were sufficiently intense. These are the physiological emotional expressions. Cannon recognized two pathological varieties of expression. Firstly, persistent derangement of bodily functions in strong emotional reactions may be due to persistence of the evoking stimuli from non-completion of the emotional reactions, due to memories or attachments which keep the reactions alive, or due to a conditioned reflex mechanism. Secondly, he could only explain the paradoxical and non-utilitarian activity of the bladder and rectum in very intense periods of emotional stress, when the sympathetic system is strongly innervated, as due to simultaneous discharge of opposed innervations, such as occurs in strychnine poisoning.

Darwin (3) recognized the visceral accompaniments of emotion, but studied principally the outward manifestations in posture and facial expression, in the superficial structures of the body and in behaviour. He was thus able to describe many different and specific manifestations of the different emotions. This has been criticized, and it has been said that the outward appearances, if separated (e.g. by photography) from the accompanying situation, are not reliable indications of the effective state. Nevertheless, Darwin's approach has the value of a study of the total living organism in its actual behaviour.

Darwin distinguished exciting emotions such as anger and joy, which naturally lead to energetic movements and depressing emotions, such as sorrow. In the latter " the sufferer sits motionless, or gently rocks to and fro ; the circulation becomes languid ; respiration is almost forgotten and deep sighs are drawn . . . collapsed muscles and dulled eyes." Pain and fear, too, may induce extreme depression or prostration.

Drawing upon the literature and upon clinical observations, I shall venture to make up a classification of the bodily effects of emotion, based primarily on the visceral changes, and to a lesser extent on the state of the voluntary muscles, including posture and general expression. (Emotional effects in the details of expression, in gesture and in language will not be considered. They may be partly direct and partly symbolic, but could perhaps justifiably be used for further subdivisions of the classification.)

Firstly, there are the pleasurable emotions. The milder forms of these produce steady and harmonious functioning of the bodily organs (including the normal activity of the gastro-intestinal tract and the general building up of bodily reserves, as described by Cannon), shift of blood from the muscles to the viscera and skin, relaxation of the voluntary muscles and of posture, and appropriate facial expressions. The more acute forms of the pleasurable emotions produce the general picture of emotional excitement as described by Cannon—palpitation, trembling, sweating and so on (e.g. sexual excitement).

Secondly, there are the unpleasant emotions, which, I suggest, may be divided into three groups :

(A) Associated with grief or sorrow in normal persons and with most retarded-depressive and neurasthenic illnesses, there is a general diminution of activity. The voluntary muscles are relaxed, easily fatigued, and general voluntary movement is diminished. The eyes are sunken and the features relaxed. There may be low blood pressure, anorexia, sluggishness of stomach and bowel functions, amenorrhoea or impotence. There is an absence of the usual effects of " exciting " emotions, such as palpitations and tremor. (Admittedly, in acute grief and in agitated depressions there may be palpitation, tremor, etc. —but in such instances the actual affect is anxiety and not sadness.)

(B) Associated with emotions of an aggressive quality are positive effects, such as raised blood pressure, perhaps without tachycardia, increased respiration and voluntary muscle tone, tense posture and expression, gastric hypersecretion, hypermotility and turgescence and perhaps diarrhoea.

(C) It would seem that the bodily effects of such emotions as fear and anxiety and also of pain are either variable or lie between the two above groups. The voluntary musculature may be relaxed or tense, with or without tremor ; the blood pressure may rise or may fall ; it may fall so much that the subject faints ; there may be tachycardia or bradycardia ; flushing or pallor of the face ; sweating ; breathing may be shallow or deep, slow or rapid ; the mouth may or may not be dry, the stomach movements may be inhibited or reversed, the bowels may be costive or relaxed ; there may be frequency or precipitancy of micturition ; sometimes amenorrhoea, impotence or sexual excitability.

In each of the emotions, pleasant or unpleasant, there are more acute and more chronic forms ; and also, in each case, a physiological form, where the cause is immediate and the bodily effects not unduly persistent, and a pathological form where the cause is insufficient, indirect or hidden and where the bodily effects persist.

Now we may perhaps say that the bodily manifestations of the psychosomatic diseases correspond to those of group B—the aggressive emotions; that the bodily manifestations of depressive and neurasthenic states correspond to those of group A, while group C corresponds to the bodily manifestations of the anxiety neuroses in particular and of other states characterized by anxiety. (Hysteria does not come into the story, as its bodily effects are symbolic and not direct.)

We can, in fact, draw contrasts between the somatic effects of almost all the suggested psychosomatic diseases and the effects of psychiatric states corresponding to the other two groups:

Between the intense congestion and secretion of eyes and nose in the rhinorrhoeas; the lesser effects in ordinary tearfulness; and the many depressed patients who cannot cry.

Between bronchial asthma and the irregular, shallow or deep breathing of some anxiety states.

Between ulcerative colitis and the diarrhoea of some anxiety states on the one hand and the constipation of other anxiety states and of the depressions, and in fact the ordinary case of constipation which is so often neurotic in origin.

Between essential hypertension and the low blood pressure of neurasthenia, and the low or fluctuating or incompletely raised pressure of the cardiac neuroses.

Between the general somatic and visceral symptoms of hyperthyroidism, which are so intense and which persist during sleep; the similar but lesser symptoms of the anxiety states which usually disappear in sleep; and the sluggish visceral functioning in retarded depressions.

Between the specific changes in the cranial blood vessels in migraine and the absence of such changes in other headaches.

Between the muscular spasm of rheumatoid arthritis and the diminished muscle tone of neurasthenia.

Between pruritus, which is typically localized, and the vague, changeable, non-localized skin itching which is so common in the neuroses.

Between enuresis, which is both diurnal and nocturnal and which dates from infancy; the frequency and urgency of some anxiety states which disappear during sleep and which are contemporaneous with the illness only; and the urinary retention of depressive stupors.

Between dysmenorrhoea and the amenorrhoea which is so frequent in depression and in many other psychiatric states.

And as for the stomach, the findings of Wolf and Wolff (23), in their patient with a gastrostomy with herniated gastric mucosa agree with the argument. Pleasurable emotions of appetite led to some increase in secretion and vascularity of the mucosa and increased motility of the stomach wall. Sadness, discouragement and self-reproach led to prolonged pallor of the mucosa and hyposecretion. Acute alarm also caused pallor and diminished acid secretion. Anxiety produced hyperaemia, hypersecretion and hypermotility.

Aggressive feelings including resentment and hostility led to great increase in secretion and vascularity and to some increase in motility. Emotional vascular changes in the face regularly corresponded with similar changes in the stomach. The implications of these observations in relation to peptic ulcer and functional dyspepsia are obvious.

All these contrasts perhaps help to confirm the hypothetical classification, given above, of the emotions and their bodily accompaniments.

III. WHAT FOLLOWS FROM THE CLASSIFICATION OF EMOTIONS ?

What is the meaning of the different bodily changes of emotion ? Like all good biological explanations, Cannon's are utilitarian. I think, however, that they are over-simplified. Simple contrasts between sympathetic and parasympathetic functions, their emotional causes and their bodily effects, cannot be made so directly as he tried to do. Immensely significant though his utilitarian explanation of the bodily effects of fear is, it does not explain fully why the effects are sometimes anything but utilitarian, nor does it take note of the fact that adequate responses may sometimes be made to danger situations without fear or its bodily effects occurring. Similarly, pain is often not felt at all in the height of a danger situation, while it is often felt—even in Nature—as a result of disease or previous injury when the bodily effects are not in the least utilitarian. He offered no special discussion of the bodily effects of the depressive emotions.

The common quality of all these states seems to be one of stimulation—stimulation by outside situations, pleasant or unpleasant ; by internal instinctive drives or emotional complexes or conflicts ; and stimulation of sensory nerves in pain. This stimulation is immediately transformed into a state of energization in a particular level of the nervous system—the emotional level. This is a high level, and is partly conscious and partly unconscious. By the peculiar situation of this level of stimulation, just at the conscious-unconscious border, it is able to bring both the conscious-voluntary and the unconscious-visceral responses rapidly into action together. Not only the visceral, but also the " voluntary " motor reactions, may occur before we fully appreciate the situation consciously. One might say that this level is the only one that really commands a total response of the whole nervous system. It exercises a dual control that neither the purely conscious level nor the lower autonomic levels can exert. The emotional level, being largely primitive, and yet being both conscious and unconscious, is able to produce both a voluntary and an involuntary response. The emotional responses are therefore primarily and usually most effectively utilitarian, as Cannon has so well proved. At the same time the emotional reactions, being strong, primitive and not fully controlled, have the disadvantage of not always reacting according to true need—particularly the need of civilized man. Hence come the pathological responses—the unwanted, ill-timed, excessive or even disadvantageous bodily responses.

Again, excessive stimulation (especially by pain and by internal emotions) may lead to excessive and undesirable bodily effects. The bodily effects of fear are also often not utilitarian, but disadvantageous. They may be due to excessive stimulation, or may be over-reactions to ordinary stimulation.

I prefer to discuss the central representation of the emotions in terms of a conscious-unconscious level as above, rather than venture into an analysis of the relative roles of the cortex, thalamus and hypothalamus. The rapidity of the responses does suggest a total unitary response rather than any division of functions.

(The " stimulation " concept applies not only to the " exciting " emotions with their positive bodily effects, but also to the depressing emotions with their apparently negative effects. This is already accepted in neurasthenia. Henderson and Gillespie (8) say that profound emotional experiences are exhausting, and that the enduring nature of neurasthenia probably depends on continuation of the emotional state. I believe that the depressive affect has its own positive quality. The idea of reciprocal innervation of antagonists in both the voluntary and the involuntary nervous system has replaced ideas of positive responses and of negative responses in the sense of no response at all ; and in fact the idea of the reciprocal innervation of antagonists is undergoing modification (Langworthy (10). The apparently negative or inhibitory symptoms in depression, such as difficulty in thinking, psychomotor retardation and stupor, are probably positive effects of a positive emotional state.)

If the classification of emotions is valid, it would seem to follow : (*a*) That the central representation of stimulation by emotions and by pain at the conscious-unconscious level is necessary to provide a unitary response of the voluntary and involuntary effector organs.

(*b*) That the bodily effects of the aggressive emotions (group B) represent, both in their normal manifestations and in the psychosomatic diseases, a preparation for active, aggressive responses, even if such responses are suppressed in the latter.

(*c*) That the bodily effects of the emotions of group A, both in their normal manifestations and in the retarded-depressive and neurasthenic illnesses, represent a withdrawal from activity and from any attempt to influence the environment.

(*d*) That the bodily effects of anxiety, fear, and pain, in health and in disease, may partake of either of the first two groups, or may represent a type of response intermediate between them, or may be a mixture of aggression and withdrawal reflecting a similar conflict in the mind.*

IV. Are Aggressive Emotions Dominant in the Psychosomatic Diseases?

As one reads studies of the personality in any and in all of the psychosomatic diseases, one finds that anxiety, obsessionalism and more or less latent aggression are almost constant findings. The following are selected, but not necessarily unrepresentative, quotations from the literature.

Rogerson (17) described the personality in children suffering from asthma, and most of them also from eczema-prurigo, as irritable and aggressive, over-anxious and insecure, with intelligence much above the average.

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* As one specific instance of this, Engel and Romano (7) thought that vasodepressor syncope resulted when the primitive reflex preparation for flight or struggle was initiated, but then for some reason appropriate action became impossible or had to be inhibited.

Draper, Dupertuis and Caughey (6) found, in 80 cases of peptic ulcer, an inner sense of insecurity in 84 per cent., Oedipus problems in 97·4 per cent., jealousy and aggression in 64·9 per cent., guilt and fear related to sex problems in 49·2 per cent. and compensatory striving in 56·2 per cent.

Wittkower (20) studied 40 patients with ulcerative colitis. The personalities fell into several groups, but anxiety, obsessionalism and overt or latent aggression were present in the majority.

Dunbar (5) found in a large series of patients with hypertensive cardiovascular disease that they were in a chronic state of obsessive doubt . . . that their life histories revealed indications of compulsive character, but of relatively few outspoken neurotic symptoms . . . and that they showed general tension cloaking aggression and resentment. A characteristic statement was, "I always say 'Yes'; I don't know why. Afterwards I'm furious." She found that the characteristic behaviour pattern in coronary occlusion was compulsive striving—an urge to get to the top through hard work, self-discipline and mastery of others. The pattern was similar in cases of angina pectoris.

Although Wolff (24) did not wish to over-simplify or to claim that he had described a typical migrainous personality, he found in 46 migrainous subjects certain common personality features which he tentatively compared with the obsessive character. In his long paper he described many groupings and instances of unusual ambitiousness, perfectionism, and efficiency, orderliness, doubts and repetitions, inflexibility, caution and economy, tension, dissatisfaction and resentment.

Johnson, Shapiro and Alexander (9), drawing their conclusions principally from 29 women suffering from rheumatoid arthritis, found that the general psychodynamic background was a chronic inhibited hostile aggressive state as a reaction to the earliest masochistic dependence on the mother that is carried over to the father and all human relationships, including the sexual. The majority of these personalities learned to discharge hostility through masculine competition, physical activity and serving, and also through domination of the family. When these methods of discharge were interrupted in specific ways, the persistent increased muscle tonus resulting from the inhibited aggression and the defence against it in some way precipitates the arthritis. But these factors are found so commonly in patients without arthritis that they postulated that there must also be somatic factors.

Robertson (16) followed the observations of J. L. Halliday that in a series of middle-aged men a widespread dermatitis had followed some disaster which they felt was undeserved and which caused them to labour under an acute sense of injustice. Robertson reported some similar cases, emphasizing the patients' sense of injustice, resentment and self-pity, and noting that too rapid inquiry into the emotional difficulties might cause an acute exacerbation of the dermatitis.

Stalker and Band found that, of 67 patients with enuresis persisting after the age of puberty, 40 showed anxiety trends varying from an anxious type of personality within normal limits to anxiety neuroses, and 17 suffered from psychopathic states, of which 6 were of aggressive types.

Wittkower and Wilson (21) thought that almost all of 57 women with primary dysmenorrhoea belonged to one of two main personality groups—first, those with deep resentment of the feminine role with masculine and aggressive traits, and secondly, those with both physical and emotional immaturity, with either shut-in or anxious traits.

From these descriptions one may see that on the whole the personality structures in the different psychosomatic diseases are compounded of elements of anxiety, obsessionalism, aggression, and the group of aggressive emotions which are given such descriptions as rage, hostility and resentment. It is generally agreed in psychopathology that obsessive trends are specifically related to underlying aggressive urges, and some at least of the anxious trends must have the same source.

It is a fallacy to look for any one mental trend in a group of patients and accept it as equivalent, whether it occurs at a superficial or at a deeper level. I believe, however, that that fallacy does not arise in the present discussion, where we are looking for the dominant emotional trends which are determining the bodily responses. It does not matter here whether the person is basically passive and superficially aggressive, or basically aggressive and superficially passive, if the aggressive trends are sufficiently dominant in the whole picture to be the causes of the bodily responses.

Are we then entitled to say that aggressive trends and their bodily effects are more dominant and more frequent in the psychosomatic diseases than in other psychiatric states? This can only at present be a matter of opinion and of impressionism, but I suggest that it is so.

Freud's theory of the life instincts and the death instincts is difficult and tenebrous, but its application in general terms has brought light rather than obscurity to psychopathology. It is well described by Karl Menninger (11), who speaks of the death instinct as consisting of primary impulses of destructiveness, as opposed to the life instinct representing primary impulses of creativeness and constructiveness. The two normally become extraverted and combined in the psychological and biological phenomena of life. Their defusion and/or introjection is associated with much of the individual and social psychopathology of humanity, and Menninger describes all this vividly in relation to suicide, martyrdom, alcoholism, self-mutilation, accidents and the rest—including the psychosomatic diseases. He believes that some forms of organic disease represent structuralization of perverted functions forced upon these organs to solve unconscious conflicts, the nature of these conflicts being related to the opposition and interaction of aggressive, self-punitive and erotic components of the self-destructive tendency.

We may now relate the aggressive trends in the previous personality to the diseases developed as the bodily effects of the aggressive emotions—the process being in the interaction of the personality and its environment. Here is the important practical field of clinical study; here the causes, in an external and practical sense, may be found; and here lie the opportunities for individual and social prophylaxis and therapy; but in this theoretical paper I shall content myself with emphasizing that now, and proceed with the theoretical discussion.

Neurotic reactions to life's difficulties are more or less inadequate reactions, according to the extent of the difficulties. The psychosomatic reactions are less inadequate; there are greater striving and drive and more overcoming of difficulties, and often considerable success. There is more aggressiveness, which shows itself both in greater achievement and in the bodily reactions. But the psychosomatic patient's adaptation is less adequate, or more stressful, than that of the normal person who can cope without excessive or ill-balanced aggression, without somatic disturbances, and without part of the aggression being repressed or turned against the self. Can it also be said that in the psychosomatic disorders the aggressive component—which derives from the instinctual level—is actually quantitatively different, is stronger or more intense, than in the neurotic or in the normal? I believe that it can. There are the analogies firstly, that overt aggression appears more strongly in the aggressive psychopathic reactions, including murder and suicide, than in other psychiatric states, and that covert aggression exists more strongly in the obsessive neuroses than in other states; and secondly, an instinctual defect has been postulated by Myerson (14) in his term "constitutional anhedonia," by which he designates individuals who, from the earliest period of their lives, have shown impairment amounting to serious deficit in the important drives or desires of life—appetite, general activity and sex.

V. The Sex Incidence.

The fact that most psychosomatic diseases are more frequent in the male sex invites further speculation. According to the writers in Price's Textbook (15) paroxysmal rhinorrhoea, chronic gastric ulcer, ulcerative colitis (in the previous edition) and migraine affect the sexes equally, while exophthalmic goitre affects females six times and rheumatoid arthritis five times more often than males. Asthma is twice as frequent in males, chronic duodenal ulcer four times, atheroma and coronary occlusion are much more common, and diffuse hyperplastic sclerosis of the arteries (usually associated with essential hypertension) and angioneurotic oedema are more common in males. Stalker and Band reported that the incidence of enuresis in children was 3 boys to 2 girls, and in older persons 3 males to 1 female.

Possible explanations are:

(1) That the incidence of dysmenorrhoea, chronic arthritis and exophthalmic goitre redresses the balance.

(2) That the "functional" psychiatric states are more frequent in women, and that redresses the balance. (Incidentally, it is thought that the anxiety neuroses—the most frequent of all the neuroses—present more frequently as effort syndrome, dyspepsia and other somatic syndromes in men, and more frequently with purely emotional symptoms in women.)

(3) Again, that stronger aggressive trends in men are associated with more psychosomatic disorder.

VI. THE CHOICE OF SYMPTOM.

Possible causes of the psychosomatic diseases have been described in general terms applicable to them all. But why does one person develop asthma, another hypertension and so on ? In fact, the first question here is, Can the bodily effects of emotion be localized in one organ or in one function ? Cannon (2) stated as an aphorism that the sympatho-adrenal system, though organized for diffuse and widespread action, might influence excessively separate organs or functions. He said that the evidence for this statement was derived, not from experimental data, but from clinical testimony, and he gave as examples both neuroses, such as soldier's heart, and psychosomatic diseases, such as exophthalmic goitre.

Many specific explanations have been offered for the different varieties of psychosomatic disorder—such as some degree of variation in the personality types ; identification with a relative or friend suffering from the same disorder ; a superimposition upon an already existing organic defect, e.g. asthma following bronchitis ; a specific symbolic meaning in the symptom developed ; or a complicated psychopathological mechanism leading to the symptom. Such explanations have their validity, but at this point I would stress the constitutional aspect or hereditary predisposition to react to stress in a specific way. The writers in Price's Textbook recognize definite hereditary predisposition or familial incidence in paroxysmal rhinorrhoea, asthma, gastric and duodenal ulcer, hypertension, arteriosclerotic conditions, exophthalmic goitre, migraine and eczema. Stalker and Band found 112 enuretic relatives in the families of 60 cases of persistent enuresis.

VII. A CLASSIFICATION OF THE PSYCHOSOMATIC DISEASES.

At one end of the scale are the conditions which exist from an early age ; whose symptoms come in brief attacks, often from the slightest cause, and pass away again for the time being ; these are mostly the " allergic " diseases which may be associated with abnormal release of histamine-like substances—the paroxysmal rhinorrhoeas, migraine and urticaria. At the other end of the scale are the conditions which appear to be the result of prolonged stress ; which come on in relatively later life ; which are usually continuous or progressive ; and which are mostly associated with dysfunction of the autonomic nervous system—essential hypertension, arterial degeneration, hyperthyroidism, peptic ulcer, ulcerative colitis, chronic arthritis and pruritus. Intermediate between these two groups in their features are asthma, enuresis and dysmenorrhoea.

VIII. IMMEDIATE CAUSES.

Although the literature contains many reports of psychosomatic diseases beginning for the first time acutely after one major emotional disturbance, I doubt if that is the rule, and prefer, as indicated above, to think of constitutional predisposition, of continued environmental stresses, of migraine, etc., as repeated trigger-like responses, and of hypertension, etc., as the end-results of lengthy processes.

On the other hand, relapses and exaggerations of the psychosomatic diseases are often caused by acute and immediate emotional disturbances. Thus Davies and Wilson (4) found that of 52 relapses of peptic ulcer, proved by radiography, 42 dated from some event causing anxiety to the patient.

IX. Mixtures.

Simple, clear-cut schemes and classifications do not describe all the complexities of Nature, and although one can contrast the psychosomatic diseases with the " functional " states, one may also inquire if they often co-exist. If they do, that may strengthen the view of the emotional origin of both rather than weaken it. There is a strong clinical impression that the two groups are often associated. Among psychiatric patients a history of dysmenorrhoea, enuresis, migraine, peptic ulcer, hay fever or asthma is extremely common. Relative to their frequency in the community, hyperthyroid patients are quite often seen—especially after operation. Hypertensive and arteriosclerotic patients, of course, form a large part of psychiatric practice—but one often feels that the psychiatric symptoms, especially of anxious depression, are greater than may be explained by the circulatory disorder. On the other hand, the observation is often made that, when a major psychiatric illness such as depression supervenes, such a condition as asthma may cease.

Combinations of two or more psychosomatic diseases occur not uncommonly —both possibly associated conditions as asthma and hay fever or asthma and eczema, and others, e.g. 66 cases of persistent enuresis included 13 with a history of other psychosomatic diseases.

X. The Future.

Medicine and psychiatry have, as it were, discovered the uncharted land of the psychosomatic diseases, but nearly all the laborious, careful and detailed work of exploration has still to be done. Research to be comprehensive should, I believe, be based upon the system adopted by Stalker and Band—analysis and interpretation of data derived from (1) accurate description and enumeration of the somatic dysfunctions, (2) investigation of these dysfunctions by special physiological methods, (3) enumeration of associated autonomic or psychosomatic disorders, (4) description of the associated psychiatric states or personality types, (5) the sex incidence, (6) the family history of psychiatric and psychosomatic disorders, (7) the environmental conditions, (8) the psychopathology, and (9) the effects of both somatic and psychiatric treatment.

Treatment largely awaits the results of research. It is possible, even now, to alleviate patients' disorders by psychiatric understanding. Much has still to be learned about specific treatment. Indeed, it should never be claimed that any of the psychosomatic diseases are problems proper to psychiatry alone. Scientific advance and benefit to patients will only come if psychiatrists and physicians study and treat the patients together, at the same time, and in the same wards.

XI. ENVOI.

This paper is what my dictionary says a hypothesis is: "a supposition; an admittedly unproved assumption adopted as basis of inference, or for the sake of argument." It is intended only as a basis for further argument, or as a stimulus to further thought on the subject. It is sufficiently clear-cut and systematized to offer a general interpretation of the known facts, but it is much too systematized to be true to Nature.

A few criticisms, however, will be answered in advance:

(1) That the bodily effects of emotion are much more pervasive than described here. This may be so, but I have described the immediate and major effects, which are recognizable and which can be pathogenic.

(2) That all the psychoneuroses and so-called functional psychiatric states are associated with bodily dysfunctions. This may also be so, but they are different in quality, degree and curability from the bodily dysfunctions of the psychosomatic diseases.

(3) That the physiological, endocrine and autonomic manifestations have not been analysed in terms of anatomy and physiology. This is so, but for the description and understanding of the whole it is not always necessary to analyse the parts; the phenomena of the whole occur on a different plane and may represent a new emergence, and analysis of the parts alone may not give the complete answer to the functioning of the whole.

(4) That the contributions of internal medicine to the psychosomatic diseases have not been discussed. This is so, but they are not meant to be ignored. They are to be integrated in the future in the psychiatric study.

SUMMARY.

Although there are no rigid systems in Nature, our knowledge has to be based on systems which allow us to isolate and to classify natural phenomena and thus to attempt to understand them. Therefore, although a psychosomatic point of view should be pervasive in all medicine, it may be proper to reserve the name psychosomatic disease for the paroxysmal rhinorrhoeas, bronchial asthma, gastric and duodenal ulcer, ulcerative colitis, essential hypertension, arterial degeneration (including coronary artery disease) if occurring before the senile age period, hyperthyroidism, migraine, chronic arthritis, certain skin diseases such as urticaria and pruritus, enuresis, primary dysmenorrhoea, and possibly a few other similar diseases. Almost all these diseases have the essential common quality that the major disturbances of function correspond to known bodily manifestations of emotion.

It is argued that the bodily expressions of emotion in health and in disease can be divided into those of the pleasant and those of the unpleasant emotions. The latter can be subdivided into three groups: (A) Diminished visceral and voluntary muscle function in sadness, neurasthenia and depression, representing a withdrawal from activity and from any attempt to influence the environment; (B) increased visceral and voluntary motor function in aggressive emotions and in the psychosomatic diseases, representing a preparation for

active aggressive responses; and (c) a greater or lesser degree of mixture of the first two in normal and in pathological states of anxiety.

It is suggested that aggressive emotions have generally been dominant in the personalities of persons with psychosomatic diseases.

If the same basic mechanisms of aggression occur in all the psychosomatic diseases, hereditary influences may be one of the factors determining the choice of symptom.

I thank Prof. Sir David K. Henderson for his advice and for his interest in this work.

BIBLIOGRAPHY.

(1) CANNON, W. B. (1929), *Bodily Changes in Pain, Hunger, Fear and Rage.* New York: Appleton.
(2) *Idem* (1936), "The Role of Emotion in Disease," *Ann. Int. Med.*, **9**, 1453.
(3) DARWIN, C. (1873), *The Expression of the Emotions in Man and Animals.*
(4) DAVIES, D. T., and WILSON, A. T. M. (1937), "Observations on the Life-History of Chronic Peptic Ulcer," *Lancet*, **2**, 1353.
(5) DUNBAR, FLANDERS (1943), *Psychosomatic Diagnosis.* New York: Hoeber.
(6) DRAPER, G., DUPERTUIS, C. W., and CAUGHEY, J. L. (1944), *Human Constitution in Clinical Medicine.* New York: Hoeber.
(7) ENGEL, G. L., and ROMANO, J. (1947), "Studies of Syncope: IV. Biologic Interpretation of Vasodepressor Syncope," *Psychosom. Med.*, **9**, 288.
(8) HENDERSON, Sir DAVID K., and GILLESPIE, R. D. (1944), *A Textbook of Psychiatry.* 6th ed. London: Oxford Univ. Press.
(9) JOHNSON, A., SHAPIRO, L. B., and ALEXANDER, F. (1947), "Preliminary Report on a Psychosomatic Study of Rheumatoid Arthritis," *Psychosom. Med.*, **9**, 295.
(10) LANGWORTHY, O. R. (1943), "General Principles of Autonomic Innervation," *Arch. Neurol. and Psychiat.*, **50**, 590.
(11) MENNINGER, K. A. (1938), *Man Against Himself.* New York: Harcourt.
(12) MICHAELS, J. J., and SECUNDA, L. (1944), "The Relationship of Neurotic Traits to the Electroencephalogram in Children with Behaviour Disorders," *Am. J. Psychiat.*, **101**, 407.
(13) MEYERS, C. S. (1937), *In the Realm of Mind.* Cambridge.
(14) MYERSON, A. (1944), "Constitutional Anhedonia and the Social Neurosis," *J. Nerv. and Ment. Dis.*, **99**, 309.
(15) PRICE, F. W., Ed. (1946), *A Textbook of the Practice of Medicine.* 7th ed. London: Oxford Univ. Press.
(16) ROBERTSON, G. G. (1947), "Emotional Aspects of Skin Disease," *Lancet*, **2**, 124.
(17) ROGERSON, C. H. (1943), "Psychological Factors in Asthma," *Brit. Med. J.*, **1**, 406.
(18) RUSSELL, E. S. (1945), *The Directiveness of Organic Activities.* Cambridge: Cambridge Univ. Press.
(19) STALKER, H., and BAND, D. (1946), "Persistent Enuresis: A Psychosomatic Study," *J. Ment. Sci.*, **92**, 324.
(20) WITTKOWER, E. (1938), "Ulcerative Colitis: Personality Studies," *Brit. Med. J.*, **2**, 1356.
(21) *Idem* and WILSON, A. T. M. (1940), "Dysmenorrhoea and Sterility: Personality Studies," *ibid.*, **2**, 586.
(22) WEISS, E., and ENGLISH, O. S. (1943), *Psychosomatic Medicine.* Philadelphia: Saunders.
(23) WOLF, S., and WOLFF, H. G. (1943), *Human Gastric Function.* New York: Oxford Univ. Press.
(24) WOLFF, H. G. (1947), "Personality Features and Reactions of Subjects with Migraine," *Arch. Neurol. and Psychiat.*, **37**, 895.

THE TEST PERFORMANCE OF THE ENCEPHALOPATHIC.

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Allen's work (1, 2, 3, 4) in this series has dealt with the test performance of the brain injured and brain diseased patients. Results of the two groups on the Bellevue Intelligence Scale, Form 1, have been adequately reported both separately and comparatively. The purpose of this paper is to combine the two groups in order to analyze the test results as one group, i.e. encephalopathic group. The study of these test results includes an item analysis of subtest results obtained by this group, and a comparison of verbal with performance scores to ascertain a valid basis for scatter analysis.

Rationale for this combining procedure may be found in Cobb (5, p. 553), who reviews the literature on the effects of brain lesions: " . . . no two human brains are alike. Lesions destroying exactly the same areas in two different brains would not cause exactly similar symptoms. This is because the life experience of each person has conditioned and changed the brain so that it is unique." Also, though the brain of man is more highly developed and specialized, from the point of reference of evolution, its functional variability is demonstrable. Injury or disease in specific areas of the brain may indicate impairment of functions mediated by those areas. However, the variability of function is sufficient to preclude adequate prediction from localization of the encephalopathy alone. From such a point of view, therefore, the etiology of the encephalopathic processes is not the concern of this paper.

Wechsler (6, p. 153) does not make any differentiation between such groups when he gives " illustrations of the disorganization of the intellectual processes observed in most organic brain cases irrespective of type." The history of encephalopathy studies has been indicated by Allen in the previous studies of this series.

Procedure.

The encephalopathic group consists of 50 brain injured and 36 brain diseased patients in a veterans' hospital, making a total of 86 subjects. The brain injured are those who sustained actual penetration of the encephalon by bullet or shrapnel piece, i.e. traumatic. The brain diseased includes those patients with intracranial organic pathology, non-traumatic. Not included in this group are patients suffering from epilepsy, psychomotor seizures, convulsive disorder, aphasia or psychosis.

The chronological age range is 20 to 55 years, the median age-point is 28 years. The distribution is skewed toward the older end, with modes occurring at years 21, 22 and 30, which includes nearly a third of the cases. Of 59 patients for whom school achievement is recorded, one had two years of college, one had one year of college, 22 completed the 12th grade, 13 did not finish high school, 14 reached the 8th grade, and 8 did not finish grade school. All patients were given routine psychological examinations, of which the Bellevue Intelligence Scale, Form 1, was part.

RESULTS.

The mean intelligence ratings for the group are distributed as follows : Full scale I.Q., 97, 1·9 ; verbal, 101·1, 1·5 ; performance, 92·6, 2·5. The mean I.Q. ratings fall within the limits of the normal range. An 8·5 difference between verbal and performance scores results in a critical ratio of 2·9, which may be considered significant.

TABLE I.—*Mean Subtest Weighted Scores.*

	V.	I.	C.	A.	D.Sp.	S.	P.A.	P.C.	O.A.	B.D.	D.Sy.
Mean . . .	10·4	11·1	10·4	9·1	7·1	9·2	8·5	9·5	8·0	7·9	6·9
Sigma mean .	·29	·28	·27	·41	·31	·38	·31	·33	·44	·36	·32

Table I presents the means of the 11 subtest weighted scores. The order of *resistance* for each of the subtests to the encephalopathic processes from greatest to least is : Information, Vocabulary, Comprehension, Picture Completion, Similarities, Arithmetic, Picture Arrangement, Object Assembly, Block Design, Digit Span and Digit Symbol.

The critical ratios for the differences between subtest scores are shown in Table II. Italicized numbers are the significant C.Rs. Digit Span and Digit Symbol deviate most significantly and consistently from Vocabulary, Information and Comprehension. The rank-order differences indicated by an inspection of Table I are supported in Table II. Block Design, Object Assembly, and Picture Arrangement, likewise, indicate significant deviations, though with less difference-reliabilities and in an order in keeping with that shown by the mean weighted scores of Table I. The five subtests at the lower end of the order of resistance, i.e. least resistant to encephalopathic processes, deviate more from Information than from Vocabulary, which is similar to findings in the earlier studies (1, 3).

TABLE II.—*Summary of the Inter-subtest Mean Weighted Score Critical Ratios.*

	V.	I.	C.	A.	D.Sp.	S.	P.A.	P.C.	O.A.	B.D.	D.Sy.
V . . .	—										
I . . .	1·8	—									
C . . .	0·1	1·7	—								
A . . .	2·6	*4·1*	2·7	—							
D.Sp. . . .	*7·8*	*9·5*	*8·0*	*3·7*	—						
S . . .	2·4	*3·9*	2·5	*3·1*	*4·3*	—					
P.A. . . .	*4·5*	*6·3*	*4·7*	1·1	*3·1*	1·5	—				
P.C. . . .	2·0	*3·7*	2·2	0·8	*5·3*	0·5	2·2	—			
O.A. . . .	*4·5*	*5·9*	*4·6*	1·7	1·7	2·1	0·9	2·7	—		
B.D. . . .	*5·3*	*6·9*	*5·5*	2·1	1·6	2·5	1·2	*3·2*	0·2	—	
D.Sy. . . .	*8·2*	*9·9*	*8·4*	*4·2*	0·6	*4·7*	*3·6*	*5·7*	2·1	2·1	—

DISCUSSION.

These results suggest the manner in which the encephalopathic processes are at work in the human individual. In terms of the average weighted scores, there is an 8·5 difference between verbal and performance abilities, in favour of the former. The gross effect of these processes appears to be in the area of motility, or motor co-ordination. However, this obvious deficiency may only be correlative with, or the result of, more insidious disabilities, which are mediated by the patients' performances on the Scale.

The function which this scale taps is the ability of an individual to respond to stimulation in terms of his past experiences. Memory is perhaps the most basic, with the ability to attend its simplest manifestation. Broadly, out of this analysis and synthesis are developed. This complex form of organization includes planning, anticipation and shift. The subtests tap this function in varying degrees, depending upon the items. Vocabulary, Information and Comprehension hold against the encephalopathic processes because memory, without its more complex organizational aspects, is largely dependent on the general training and background of the subject. The other subtests hold less well because of the increasing demand for more organizational activity. The order of resistance noted in Table I acts as a rough indication of the degree of organization necessary. Unless the organic lesion directly involves the motor system of the patient, it is this failure to *organize* the problem adequately which results in difficulties manifested by poor motor manipulation.

The results of the Digit Symbol and Digit Span subtests illustrate this point. Very high critical ratios for the differences between the mean weighted scores for these two subtests on the one hand, and Vocabulary, Information and Comprehension scores on the other, were found. The critical ratios for Digit Symbol and Digit Span decrease as they are compared with other subtests which are themselves affected by the encephalopathic processes. Significant differences between Digit Symbol and all other subtests with the exceptions of Digit Span, Object Assembly and Block Design are shown in Table II. It would appear, therefore, that the absence of significant differences between these four subtests strongly suggests that motor manipulation and motor co-ordination are not the critical functions impoverished by the encephalopathic processes. Digit Span in no way involves motility, while Object Assembly depends very little on motor co-ordination *per se*. From this it seems that the encephalopathic patient has difficulty in conceptualizing a problem, in breaking it up into its constituents and re-grouping the parts into a logical whole.

Correlative aspects of the organizational ability which may be part of its general dysfunction are anticipation and shift. The patient's ability to set himself into a state of preparedness, and to alter this state according to the demands is hampered. Also involved are the patient's reactions to success and failure on the test items. The anxieties which may be a part of his reaction to his physical disability may be provoked to an even greater extent by the testing situation. Time pressure can also serve to disrupt any train of organization.

The order of resistance given above may serve as a point of reference fo the design of scatter analysis patterns. The Information subtest weighte score may be used as a basal point for computing the deviation of the othe ten subtest weighted scores. This may also be used as a basis for the estimation of the pre-encephalopathic intelligence, since Information, Vocabular and Comprehension hold well against all except the most insidious deterioration and, of course, psychotic blocking.

Conclusion and Summary.

The purpose of this paper has been to study the effects of traumatic an non-traumatic encephalopathy on patients as measured by the Bellevue Intelligence Scale, Form 1. A total of 86 subjects were studied, 50 brain injure and 36 brain diseased, in a veterans' hospital. The results indicate a significan difference between verbal and performance abilities, as tested by this scale The handicap of the organic patient on this scale appears to be most obviousl in the area of motor manipulation. It is possible, however, that this difficult is simply the manifestation of the organic patient's inability to organize, t analyze and synthesize incoming stimuli, which results in the terminal an observable inability to manipulate manually. A basis for scatter analysis an estimates of pre-deterioration intelligence is suggested by the order of resistanc of the Bellevue subtests to the encephalopathic processes. This order, fro most to least resistant, is: Information, Vocabulary, Comprehension, Pictur Completion, Similarities, Arithmetic, Picture Arrangement, Object Assembly Block Design, Digit Span and Digit Symbol.

Bibliography.

(1) Allen, R. M. (1947), "The Test Performance of the Brain Injured," *J. clin. Psychol.*, **3**, 225-230.

(2) *Idem* (1948), "A Note on the Use of the Wechsler-Bellevue Mental Deterioration Index with Brain Injured Patients, *ibid.*, **4**, 88–89.

(3) *Idem* (1948), "II. The Test Performance of the Brain Diseased," *ibid.*, **4**, 281–284

(4) *Idem*, "A Comparison of the Test Performances of the Brain Injured and Brain Diseased," to appear in *Amer. J. Psychiat.*

(5) Cobb, S. (1944), "Personality as Affected by Lesions of the Brain," in Hunt, J. Mc., *Personality and the Behaviour Disorders*, **1**, 550–581.

(6) Wechsler, D. (1944), *Measurement of Adult Intelligence.* Baltimore: Williams & Wilkins. (3rd edition.)

BIRTH INJURY AS A CAUSE OF MENTAL DEFECT: THE STATISTICAL PROBLEM.

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Clinicians often assume, in a somewhat casual manner, that injury to the brain at birth has been the cause of this or that case of defect. Cerebral diplegia, hemiplegia, hydrocephaly and numerous types of cerebral maldevelopment have been attributed to this cause. Some American psychologists have tended to ascribe to birth injury every case of defect with plegia (Doll, Phelps and Melcher, 1932). Equally categorical denials of the influence of birth trauma in the aetiology of mental defects have been expressed (Berry, 1933). The decision between these opposing points of view involves the examination of some difficult questions. There are two rather obvious principles to be applied. First, any case in which birth injury is diagnosed must present symptoms or signs, which could reasonably be attributed to this cause. Secondly, a history of events at the time of birth must be ascertained and the evidence carefully weighed with a view to finding out whether conditions likely to produce injury were present. A third point to be kept in mind is that, even when proof of cerebral injury at birth is reasonably complete, the effect of such injury on the intelligence level has still to be assessed. In any given case of defect with a possibility of birth injury, we must ask ourselves what the intellectual level would have been in the absence of such injury.

The inferences drawn by Little (1861), who wrote papers on the influence of abnormal parturition, difficult labours, premature births and asphyxia neonatorum on the mental and physical condition of the child, have inclined physicians to take a very liberal view of the possibilities of birth injury. Later workers were more cautions and, in particular, neurologists, whose ideas were grounded on histology and pathology. The reaction began with Freud (1897), who refused to attribute cerebral diplegia to injury in the majority of cases. This viewpoint is to a large extent supported by modern genetical findings, and it has become a general rule to confine the diagnosis of trauma to asymmetrical lesions. Symmetrical cerebral diplegia occurs as a familial condition affecting more than one sib. Families have been frequently described in which the parents are unaffected yet consanguineous, strongly suggesting that rare recessive genes are causal agents in numerous instances.

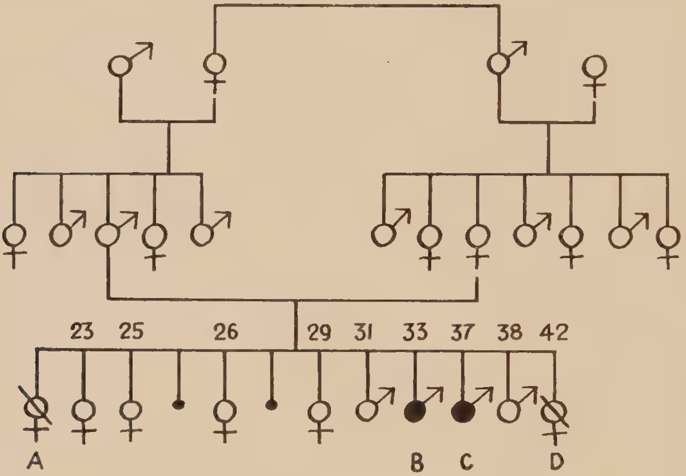
The aetiological distinction between symmetrical and asymmetrical congenital plegias can clearly be shown by family history study. The figures shown in Table I are taken from data collected some years ago (Penrose, 1939). Among the hemiplegias in this series no familial cases were found, but several of the diplegias had similarly affected sibs. The familial incidence was low and did

TABLE I.—*Congenital Cerebral Palsy.*

The 68 selected patients are cases of mental defect with signs of pyramidal lesions, bu without other physical malformation.

	Sex.	Clinical type. Asymmetrical.	Clinical type. Symmetrical
Number of patients	M.	21	21
	F.	7	19
,, of sibs similarly affected	M.	0	4
	F.	0	4
,, of patients with related parents		0	5

not amount to more than about one in twenty among sibs of the patients. The raised consanguinity rate also suggested strongly that some cases, like that whose pedigree is given in Fig. 1, were due to rare recessive genes. This



A. Stillborn.
B. Mental age 9 years 6 months at age of 13 years 9 months. Symmetrical diplegia. (*M.R.C. Sp. Rept.*, No. 229 (1938), Case No. 333).
C. Normal intelligence: Diplegia affects legs only.
D. Died, aged 2½.

FIG. 1.—Familial diplegia.

explanation, however, could only apply to a proportion of the cases and some may well be due to intranatal disasters at birth or even to prenatal disturbance (Stewart, 1942). Furthermore, the effects of incompatible antigens, as in kernicterus, must also be considered seriously as etiological suspects. In most cases of fairly evident hereditary origin, the lesions are symmetrical, but Hanhart (1947) has found two closely related cases of congenital hemiplegic defect, which he ascribes to genetical influence. Conversely, though it is difficult to believe that a traumatic haemorrhagic lesion can be often symmetrical, necrosis of cells due to asphyxia would naturally be expected to affect both sides equally. Finally, some congenital hemiplegias are attributed to prenatal developmental malformation of unknown origin associated with cystic degeneration or haemangiomata. For some of these obscure defects early antenatal maternal infectious diseases are now being blamed. Thus the problem of diagnosis of trauma from the examination of physical signs many years after the causal injury, even in apparently straightforward cases, is not easy—even if a case comes to autopsy. Without a complete family investigation and personal (including maternal) history, correct evaluation of trauma as a cause of defect is impossible.

The matter can be treated to some extent statistically by collecting data to enable us to estimate how much weight is to be given to any circumstances found, which may point to birth trauma. Unfortunately, there is hardly any field in which statistics are less reliable. However, we can get some information on the importance of various influences, such as intranatal asphyxia, premature birth, primogeniture and so on, by the ordinary methods of collecting and tabulating medical data. For example, MacGregor (1943) listed the causes of stillbirth and neonatal death in 760 autopsies. She attributed the fatality to intracranial haemorrhage in 36·4 per cent. of the cases and to asphyxia in 40·3 per cent., though she also noted that these two categories overlapped. This would mean that at least 1½ per cent. of live births died of cerebral injury. Nevinny (1936) considered that about one third per cent. of all live births had definitely proved intra-cranial injury, but that 1 per cent. were probably so injured. He called attention to the importance of long labour, but mentioned the danger of asphyxia as instanced by cerebral haemorrhage occurring in cases of Caesarian delivery. Rydberg (1932) made a careful pathological and clinical study of infants who had suffered cerebral injury at birth. He also emphasized the importance of asphyxia and congestion as a condition predisposing to haemorrhage, but he pointed out that a certain amount of subdural bleeding could occur without any permanent injury. This view agrees with that of Ehrenfest (1931), who considered that a very large proportion of infants after normal parturition showed signs of slight intracranial haemorrhages. Severe injuries are recognized at birth by pallor, tension over the fontanelle, convulsions and so on and, when the result is not fatal, permanent defect may result. Thus, Rydberg collected 48 surviving cases with histories of cerebral traumatic symptoms during the first days of life and found 16 of them to be idiots or imbeciles. Ten more were mentally retarded to a lesser degree. Only nine cases were without any residual mental or physical signs.

One of the most important factors predisposing the infant to cerebral birth trauma is prematurity. This is agreed by all observers. MacGregor, for example, found that neonatal deaths were nearly 16 times as frequent among premature as among full term infants. But neonatal deaths due to intracranial haemorrhage were 21 times as frequent in the premature infants, while neonatal deaths due to asphyxia were more than 30 times as prevalent. Taking the matter a step further, Brander (1936) examined the intelligence levels of children who had been premature infants, in a large series of 376 cases, at the same time summarizing previous surveys. Most, but not all, previous observers had noted an excess of defectives and diplegias in their samples. Brander compared the distributions of measured intelligence in his premature group with the general population. He concluded that the premature infants were slow in learning to walk and to speak; 42 of them, or 11 per cent., were rated mentally defective against 2 per cent. to 4 per cent., in the general population. This conclusion agrees with that of Rosanoff and Inman-Kane (1934), who found premature birth to be more common among defectives than among members of the general population. A difficulty in accepting that prematurity and consequent birth trauma was responsible for mental defect in all these cases was shown by the fact that there were two mongols in the group. Presumably, in some instances, malformation associated with severe mental defect is itself a cause of prematurity. Furthermore, the criterion of prematurity based on a birth weight less than 5½ lb., which applies to from 4 to 6 per cent. of all infants, is, in many ways, unsatisfactory. Not all light infants are truly premature, though some heavy ones may be. Post-maturity is also a potent cause of neonatal death and stillbirth (Bickenbach, 1947) and excessive foetal size may well predispose to cerebral injury at birth. The correct criterion of abnormality should combine both birth weight and duration of pregnancy.

Some of the diagnostic points susceptible to statistical inquiry are related to birth order and maternal age. It is generally believed that there is more danger of injury for first born than for later children, especially if the mother is relatively elderly. Nevinny found two-thirds of cases of intra-cranial injury occurred in primiparous births. Furthermore, primiparae were specially liable to have infants with tentorial tears. Thus, one of the signs possibly favouring diagnosis of birth injury may be a history of primogeniture. Unfortunately, the proof of the aetiological significance of primogeniture in any disease is an elusive problem. Pearson (1914) attempted to show, on statistical grounds, that the first-born child was physically and mentally handicapped, but he failed to do so convincingly. Congenital pyloric stenosis and some other abnormalities were believed by Still (1927) to be unduly frequent among the first-born. It is extremely hard to prove this statistically, partly because of family limitation after an abnormal birth and partly because present day sibships are so small. In the general population at the present time almost exactly 40 per cent. of all births are first births.

Maternal age is possibly a factor in producing intracranial injury because parturition in very young and in elderly mothers presents increased danger to the foetus. The incidence of neonatal deaths rises at the extremes of maternal age. It is lowest between the maternal ages of 20 and 29 and is doubled after the age of 40; also the risk is increased for first births at all ages. Although neonatal deaths are often caused by trauma and asphyxia, malformations predispose to these accidents and malformations of all kinds tend to be distributed at the extremes of maternal age. Nevertheless, an increase in the range of maternal ages for birth injury cases may reasonably be looked for and also a slightly older mean maternal age. Owing to the possibility that first births may be especially affected, the mean maternal age tends, however, to be low and it is difficult to make the appropriate corrections when estimating expectation.

Table II shows that plegic defective patients of all types are more often first-born than expected, but with infants with congenital developmental

TABLE II.—*Analysis of Numbers of First-born Cases of Mental Defect.*

	Congenital cerebral palsy.	Anencephaly, spina bifida or hydrocephaly.	Institutional cases of all types.
Number of cases	76	144	1099
Mean maternal age	28·7 yrs.	31·3 yrs.	29·9 yrs.
Observed number of first-born	26	49	325
Expected number first-born, allowing for maternal age	21·6	41·2	307·4
Excess of observed first births over expectation	+ 4·4	+ 7·8	+ 17·6
Standard error	± 2·8	± 3·8	± 12·4

defects, such as hydrocephaly and spina bifida, the effect is stronger. In the data, summarized in Table II, the children were born 40 years ago, when families were somewhat larger than they are now and the estimations of proportions of first-born to be expected are based upon the internal evidence of the families themselves. There are opportunities here for further inquiry.

Finally, we come to the practical problems of diagnosing defectiveness due to birth trauma in the light of all these facts and of estimating their frequency among other institutional patients.

In my series of 1,280 defectives, examined between 1930 and 1937, I found only 11, whose physical conditions combined with their histories, warranted the diagnosis of birth injury as the main cause of their mentally defective states (see Table III). I could have said that in a great number of other cases birth trauma was a part cause of defect but, in these, the diagnosis would only have rested upon vague suspicions and I had to obtain adequate support

TABLE III.—*List of Cases of Mental Defect Due to Birth Injury.*

Sex.	Serial number.*	Signs.	I.Q.	Maternal age (in years).
F.	15	Hemiplegic, epileptic	9	39
M.	74	Hemiplegic	11	24
M.	75	Hemiplegic, epileptic	5	27
M.	102	Peripheral nerve lesions (arms and face)	56	28
M.	218	Hemiplegic, epileptic	50	30
F.	220	,, ,,	53	32
F.	687	,, ,,	48	29
M.	760	Hemiplegic with pituitary dystrophy	36	37
M.	912	Hemiplegic, epileptic	50	27
M.	1067	Hemiplegic	61	21
M.	1150	Hemiplegic, epileptic	23	29
8 M., 3 F.	Means		36·5	29·4

* *M.R.C. Sp. Rept.* 229.

TABLE IV.—*List of Cases of Mental Defect Due to Post-Natal Trauma.*

Sex.	Serial Number.*	Signs.	I.Q.	Maternal age in years.
F.	326	Hemiplegic	19	24
M.	521	Epileptic	64	29
M.	538	Hemiplegic, psychopathic	73	27
M.	561	Hemiplegic, epileptic	57	n.k.
M.	654	Psychopathic	51	19
M.	726	Ataxic	50	n.k.
M.	755	Epileptic	9	33
M.	827	Behaviour disorder	83	28
M.	911	Hemiplegic, epileptic	30	36
M.	965	..	21	26
M.	1193	Hemiplegic	90	33
M.	805	Hemiplegic, epileptic	25	33
10 M., 1 F.	Means		47·7	28·8

* *M.R.C. Sp. Rept.* 229.

in each case from the neurological expert, Prof. S. Nevin. The proportion of fairly certain cases due to birth injury among these institutional defectives was thus rather less than 1 per cent. Among them were 8 males and 3 females. All except one case showed signs of pyramidal lesions. Usually only one side of the body was affected and if both sides were paralyzed they were affected unequally. Seven were definitely epileptic. In one case there was an associated pituitary dystrophy. Labour had been abnormal in every instance. One had a history of persistent occipito-posterior delivery; another had been a difficult breech case; another, obstructed labour with subsequent Caesarian delivery. Six out of the 11 were the results of first pregnancies. The maternal age varied between 21 and 39 years and averaged 29·4 years, a not unusual distribution for a set of normal births. The intelligence levels of the cases varied from low grade idiocy (I.Q. 5 points) to high-grade feeblemindedness (I.Q. 61 points) and averaged 36·5 points I.Q. Comparison with 12 cases, 11 male and 1 female, of defect due to post-natal injury, in the same sample of 1,280 patients, showed some points of similarity. Thus, marked neurological signs were present in 8 cases, 5 were epileptic, 2 psychopathic and 6 had pyramidal lesions. The I.Q. varied from 9 to 90 points and averaged 47·7 points. This mean I.Q. is higher than that found for the birth-injured cases —not unexpectedly, for, in these cases of post-natal injury there was a definite history of decline in mental powers after an accident in which the child had received a severe blow on the head. That is, normal development had preceded the accident for a longer time than in the cases of birth injury. In both the natal and post-natal traumatic cases, males were much in excess of females.

I must apologize to my readers for not having presented them with a more clear-cut account of the statistical background of this subject. I can, however, plead that the fault is not altogether my own. There is a great deal of work yet to be done in this field and I have merely drawn attention to some of the possible lines for further investigation in the hope that those who are in close contact with the clinical material may profit from my incomplete observations.

References.

Berry, R. J. A. (1933), *Eug. Rev.*,**24** , 288.

Bickenbach, W. (1947), *Geburtshilfe u. Frauenheilk.*, **7**, 3.

Brander, T. (1936), *Studien über die Entwicklung der Intelligenz bei frühgeborene Kindern.* Helsingfors.

Doll, F. A., Phelps, W. M., and Melcher, R. T. (1932), *Mental Deficiency due to Birth Injuries.* New York: Macmillan.

Ehrenfest, M. (1931), *Birth Injuries of the Child.* New York: Appleton.

Freud, S. (1897), "Die infantile Cerebrallähmung." Notnagel, *Sp. Path. u. Therap.*

Hanhart, E. (1947), Personal communication.

Little, W. J. (1861), *Obst. Trans.*, **3**, 293.

MacGregor, A. R. (1943), *Edin. Med. J.*, **50**, 332.

Nevinny, H. (1936), *Uber die geburtstraumatischen Schädigungen des Zentralnervensystems.* Stuttgart: F. Enke.

Pearson, K. (1914), *On the Handicapping of the First-Born.* C.U. Press.

Penrose, L. S. (1938), "1280 Cases of Mental Defect." *Med. Res. Co. Sp. Rept.*, No. 229. London: H.M.S.O.

Idem (1939), *Am. J. Ment. Def.*, **44** (1), 33.

Rosanoff, A. J., and Inman-Kane (1934), *Am. J. Psychiat.*, **13**, 829.

Rydberg, E. (1932), *Cerebral Injury in New Born Children Consequent on Birth Trauma.* Copenhagen: Levin & Munksgaard.

Stewart, R. M. (1942), *Proc. Roy. Soc. Med.*, **36**, 25.

Still, G. F. (1927), *Lancet*, **2**, 795 and 853.

ELECTRONARCOSIS AT THE HOMEWOOD SANITARIUM, GUELPH, ONTARIO.

By J. J. Geoghegan, M.B., Ch.B.

Preliminary Report.

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Introduction.

Electronarcosis is considered in some places to be as good as insulin in the treatment of schizophrenia (1, 2, 3, 4). One publication on the subject emphatically states that electronarcosis is only equivalent to E.C.T. as a therapeutic measure (5). There is such a marked difference of opinion in these preliminary reports that one wonders if we are dealing with the same procedure

This treatment might be regarded as the natural sequence to insulin coma and electroconvulsive therapy. Indeed, when we consider how long insulin and electroconvulsive therapy have been used, it is a wonder that electronarcosis has been neglected for so long. Electronarcosis was first used experimentally on animals as far back as 1902, without any ill effects clinically o neurologically (6). Various types of current were used, such as unidirectional pulse, direct and alternating currents. Little or nothing was done about i until within the last few years, when American workers, after intensive and prolonged experimentation on animals with various types of currents and frequencies, were favourably impressed with the ease and safety of the procedure (7, 8). Even after prolonged application of electric currents of high intensity, in some cases prolonged for hours, no evidence of gross or microscopic brain damage was noted. Finally, patients suffering from schizophrenia were treated with electronarcosis with results stimulating enough to warrant its continuation.

Selection of Patients.

This preliminary investigation deals mostly with patients suffering from schizophrenia, although a few patients with affective conditions were also treated. Some of the patients had been treated with E.C.T. or insulin, o both, without response, while others had received no previous shock therapy As this study progresses we hope to be in the position to make the following investigation on schizophrenic and other mental deviations :

(1) A comparison of electronarcosis and insulin results when no previou shock therapy has been used.

(2) A comparison of the results of E.C.T. failures treated with electronarcosis with E.C.T. failures treated with insulin. Some investigation has already

been done on the latter at the Ontario Hospital, London, with somewhat revealing results (9).

(3) The results of insulin failures treated with electronarcosis.

(4) The results of electronarcosis failures treated with insulin. We have already commenced this investigation. One electronarcosis failure recovered on insulin and two are still receiving insulin.

Our patients have been divided into two groups, (*a*) those ill less than 18 months and (*b*) those ill 2 years or more. All patients receive the usual pre-shock examinations. As electronarcosis is said to be more hazardous than E.C.T. only those in good physical condition have been selected.

TECHNIQUE.

Our technique at Homewood differs in many respects from that of the other centres using the treatment, but the essential nature of the treatment is unchanged. Our patients receive their ordinary breakfast at eight o'clock in the morning. One half hour before treatment is administered each patient receives atropine sulphate, gr. $\frac{1}{100}$. This prevents excessive salivation during the treatment and eliminates dyspnoea and restlessness. The patient comes to the treatment room in ordinary everyday clothing, lies on a hospital bed without the usual rigid surface underneath and the spine is slightly hyperextended over an ordinary pillow. The patient then receives an intravenous injection consisting of half a gramme of sodium pentothal in 5 c.c. of distilled water. This injection results in immediate sleep, which eliminates nervousness, facilitates the proper placement of the electrodes, to some extent buffers the initial tonic contraction and eliminates post-treatment excitement.

The electrodes are wrapped in gauze moistened with normal saline and placed 3 in. in front of the anterior border of the mastoid process and $1\frac{1}{2}$ in. above the zygoma. Multiple small electrical burns are common when uncovered electrodes are used. Electrogel is liberally applied to the skin underneath. Electrodes should not be placed farther back than $2\frac{1}{2}$ in., otherwise stridor and a superficial coma will result. An ordinary air-way is placed between the patient's teeth to protect the tongue during the first stage of the treatment and facilitate respiration during the second phase.

The machine in use at Homewood is a 60-cycle A.C. unit equipped with a glissando unit. The pre-set current by this device takes exactly 1·2 seconds to reach its peak. The glissando in the new B.S.T. unit is of much shorter duration and accounts for the greater violence of the initial contraction and the relatively high fracture incidence. This gliding increase in the current results in a soft initial contraction and eliminates or almost eliminates compression fractures of the vertebrae. It is therefore possible with the patient deeply asleep to lower the pre-set current to the region of 130 milliamperes, thus eliminating the usual violent initial tonic contraction. When the treatment switch is placed in the "on" position the pre-set amplitude is reached in exactly 1·2 seconds, the higher the amplitude the more violent the contraction. The current is then rapidly increased manually to 300 milliamperes for 8 seconds, lowered to 250 milliamperes for the next 10 seconds, then to 200 milliamperes until the 30-second mark is reached, and then to 50 milliamperes. By this method controlled clonic contractions are almost invariably present at the 20-second mark and usually continue for 10 or 15 seconds. Violent contractions can be further controlled by increasing the current from 50 milliamperes to 70–100 milliamperes, and at the end of the clonic phase again decreasing it to 50 milliamperes. Respiration is usually re-established at the end of one minute, when the air-way is pushed into position. A mixture of 95 per cent. oxygen and 5 per cent. carbon dioxide is then run into a respiratory mask and the patient breathes this mixture for the duration of the treatment. It has been our experience that the initial current must be high enough to stimulate clonic contractions in order to produce the narcotic type of electro-coma.

With the air-way now in position and the patient breathing freely of carbogen the second phase of the treatment commences. It is customary in most other centres to increase the current by 5 milliamperes per 15 seconds until the onset of mild stridor and flexor rigidity of the arms. Our experience has been that the slow increase of current as used above frequently results in a restless treatment characterized by torsion movements, purposeful movements of the hands and generalized restlessness. We have found that a rapid, steady increase in the current amplitude, within reason, facilitates deepening coma and the patient has no opportunity of re-awakening. At the end of 2 minutes, therefore, our milliammeter usually registers between 110 and 140 milliamperes. At the end of 3 minutes the milliammeter registers, if necessary, between 150 and 180 milliamperes. By this time the patient is in the electronarcosis state —legs extended, arms flexed, hands in carpo-pedal spasm, no restlessness and mild stridor. We do not consider this elevation of current harmful—in fact, we believe that it is necessary to elevate the current to at least 150 milliamperes to ensure a deep narcosis. Secondary *grand mals* are not met with despite this high amplitude. If stridor occurs and is severe enough to interfere with the treatment the electrodes can be moved anteriorly with immediate reduction of stridor. Simultaneously there is usually some decrease in the flexor rigidity of the arms and a further increase of the current is therefore necessary to maintain deep coma. It can be said that the further forward the electrodes are placed the higher will be the current necessary to ensure an adequate narcosis. The current is maintained at the required level for 8 or 10 minutes, when it is gradually decreased to zero and the treatment is at an end. The progress of the patient thereafter is similar to that of the E.C.T. treated patient.

When the treatment is administered to a patient who has not been atropinized, respiration is continuously impeded by excessive salivation. This can be adequately taken care of by a suitable suction apparatus, but the frequent application of this apparatus naturally deprives the patient of a large amount of CO_2 and oxygen. Atropine, administered to the patient half an hour before the treatment, almost entirely eliminates this troublesome feature of the treatment.

At the commencement it is customary to give the patient three electronarcosis treatments per week. In some centres it has been recommended that the treatments be continued until the patient has had 20, 30 or 40 comas, as is usually the case with insulin treated patients. Others recommend that the treatment be continued until the patient shows improvement, when the treatments are given twice weekly for two weeks and then once during the last week of treatment. For the first two months we continued the treatments until the patient had received 30 comas. It soon became evident, however, that patients responding to electronarcosis usually did so, as is the case with E.C.T., from about the sixth to the fifteenth treatment. In other words, at this early date of our investigation, we are inclined to believe that most of those schizophrenic patients who will respond to electronarcosis will do so with the first ten treatments and that the remainder will probably respond when they have received about 15 or 20 treatments. When the patient has shown marked clinical improvement electronarcosis is given twice a week for one or two weeks and then one final treatment. We have also decreased the duration of these latter treatments to 5 minutes. This is then followed by a period of two or three weeks' observation, when the disposal of the patient is then considered. Most patients who have not responded satisfactorily to the fifteenth or twentieth treatment will not, in our opinion, respond to a larger number. A longer period of time, however, will be necessary before this conclusion can be made with certitude.

The duration of each treatment is arbitrary. Most centres prolong the treatment to 7, 8 or 12 minutes. At the commencement of the investigation we followed this closely, but within a short time we gradually extended the duration to 15 minutes. In two cases, both showing no improvement to intensive electronarcosis, the duration was extended to one hour and three hours respectively. Neither untoward nor beneficial effects were noted. We noticed that when we limited the duration of the treatment to 7, 8 or 10 minutes we had little or no post-treatment confusion or amnesia. When, however, the treatment was extended to 15 minutes there was a marked increase in the incidence of memory disturbance and confusion, particularly the latter. We have, therefore, shortened our treatments to 8 minutes.

TYPES OF ELECTRONARCOSIS.

Two types of reaction have been described. One is called the "narcotic type" and the other the "hyperkinetic type." The former has been more common in our experience, particularly when the patient has shown definite clonic contractions at the end of the first 30 seconds. The patient lies quietly, with legs extended, arms flexed, no cyanosis and little or no stridor. When clonic contractions have not been elicited the patient usually becomes restless about the fourth or fifth minute. This restlessness manifests itself by torsion and purposeful movements, respiratory difficulty and noisiness. In such cases we have found it beneficial to sweep the current manually up to 300 milliamperes for a period of 15 seconds and gradually return it to its former level. A second *grand mal* usually results from this procedure and a quiet narcotic treatment may be effected. In some cases, particularly in those who have not responded after the twentieth treatment, we have terminated further treatments with a second *grand mal*. We have not, however, noted any beneficial results from this procedure.

CLINICAL FINDINGS.

During the first 30 seconds of the treatment most patients showed marked irregularities of heart action—cessation, bradycardia or tachycardia. This was usually associated with changes in blood pressure. Blood pressure readings taken during the first phase were difficult to estimate because of muscular tension and adventitious sounds. When the current was dropped to 50 milliamperes and from then on for the duration of the treatment, all patients showed marked tachycardia with elevation of blood pressure. This elevation was present in both systolic and diastolic readings. Pilomotor reactions such as flushing of the skin, sweating, etc., were also almost universally met with. These findings have all been fully recorded in other reports (10). Electrocoma appears to be deepest immediately following the clonic phase, when neurological phenomena are common, *e.g.* positive Babinski. Coma in the second phase never reaches the degree commonly met with in insulin therapy. Patients awaken from 2 to 35 minutes after the treatment is discontinued.

COMPLICATIONS.

(a) *Fractures*

In approximately 600 electronarcosis treatments we have had no clinical evidence of compression fractures of vertebrae. We have not, however, carried out post-treatment X-rays on any of our electronarcosis patients as none of them complained of backache. This is unquestionably the result of the special glissando technique, deep sedation of the patient and the low initial milliamperage (11). Fractures of other bony structures were not encountered.

(b) *Memory Disturbance.*

Memory disturbance, disorientation and confusion are not more common with electronarcosis than with electro-therapy, when the usual method is used. Post-treatment excitement occurred in one patient. Amnesia and confusion are, however, more commonly met with following electronarcosis than when B.S.T. is used. The majority of our patients showed a mild degree of nominal aphasia, but no gross amnesia or confusion on treatments of 8 minutes' duration. Treatments of 15 minutes' duration or longer were complicated by gross memory disturbance and confusion in about half our cases. With few exceptions patients were not incapacitated to any extent after electronarcosis and the majority were able to participate in the regular occupational and recreational programmes in the afternoons and evenings.

RESULTS.

Sixteen patients ill less than 18 months received electronarcosis. Seven of them had had no previous shock therapy. The results are shown in Table IA. It will be noted that two patients recovered, three were much improved, one was improved and one unimproved.

TABLE IA.—*Schizophrenic Patients Ill less than 18 Months. (No previous Shock Therapy.)*

Name.	Age.	Diagnosis.	Duration in months.	Number en.	Result.*
Miss H—	29	Catatonic	4	12	1
Mrs. H—	47	Paranoid	8	15	2
Miss C—	29	,,	4	23	3
Miss G—	26	Catatonic	2	10	2
Mrs. J—	43	Paranoid	18	24	4
Mr. S—	23	,,	4	24	1
Mr. C—	31	,,	4	4	2

* 1 = recovered; 2 = much improved; 3 = improved; 4 = unimproved.

Of the 9 remaining patients, 7 were E.C.T. failures, 1 was an insulin and E.C.T. failure, and 1 responded to metrazol six years ago. The results are shown in Table IB.

TABLE IB.—*Schizophrenic Patients Unimproved with Previous Shock Therapy. (E.C.T., insulin.)*

Name.	Age.	Diagnosis.	Duration.	Shock results.	Number en.	Result.*
Mrs. McK—	32	Catatonic	16	4	31	4
Miss P—	19	Paranoid	18	4	16	1
Miss R—	23	Catatonic	6	4	16	4
Mrs. R—	37	Paranoid	5	4	14	2
Mrs. B—	45	Catatonic	4	4	15	2
Mr. K—	26	,,	16	4	27	4
Mr. P—	30	Paranoid	5	4	10	3
Miss B—	39	,,	6	4	30	4
Mr. S—	42	,,	2	1	8	1

* 1 = recovered; 2 = much improved; 3 = improved; 4 = unimproved.

Two of the 9 recovered, 2 were much improved, 1 was improved and 4 were unimproved.

The total immediate results are shown in Table IC.

TABLE IC.

Diagnosis.	Number of patients.	Results.* 1.	2.	3.	4.
Paranoid schizophrenia	10	3	3	2	2
Catatonic schizophrenia	6	1	2	—	3
Total	16	4	5	2	5

* 1 = recovered; 2 = much improved; 3 = improved; 4 = unimproved.

Nine of the 16 patients recovered or were much improved, the remainder are still in hospital.

Our second group of schizophrenic patients have been ill two or more years. The results are shown in Table II.

TABLE II.—*Schizophrenic Patients Ill Longer than Two Years.*

Name.	Age.	Diagnosis.	Duration in years.	Previous treatment and results.	En.	Result.*
Miss B—	37	P.	3	E.C.T., insulin = 4	23	4
Mrs. B—	55	I.P.	2	E.C.T. = 4	30	4
Miss C—	43	C.	20	ditto	30	3
Miss N—	36	H.	10	,,	30	4
Miss P—	19	H.	2	,,	26	4
Miss P—	22	P.	3	E.C.T., insulin = 4	23	4
Mrs. L—	41	C.	10	Met. E.C.T., insulin = 4	25	4
Mr. B—	37	C.	7	E.C.T., insulin = 4	39	3
Mr. B—	17	C.	2	E.C.T. = 4	29	4
Mr. M—	26	C.	3	*Nil*	25	2
Mr. McL—	47	P.	9	,,	36	4
Mrs. McC—	31	P.	15	,,	..	2
Mrs. D—	33	P.	4	E.C.T., insulin = 4	26	4
Mrs. J—	47	P.	4	*Nil.*	26	4
Mr. S—	34	P.	4	E.C.T. + Insulin = 2	6	2

* 1 = recovered ; 2 = much improved ; 3 = improved ; 4 = unimproved.

Of the 15 treated, 3 were much improved, 2 improved and 10 unimproved.

A small group of 5 patients with affective conditions not responding to E.C.T. received electronarcosis. The results are shown in Table III.

TABLE III.

Name.	Age.	Diagnosis.	Duration.	E.C.T. results.	Number en.	Result.*
Mrs. W—	58	Invol. melan.	12 months	4	28	4
Mrs. A—	51	ditto	15 ,,	4	11	2
Mr. T—	58	,,	8 ,,	4	14	4
Mrs. Y—	38	Par. state	6 ,,	4	6	1
Mr. J—	57	Schizo-manic	2 ,,	4	6	1

* 1 = recovered ; 2 = much improved ; 3 = improved ; 4 = unimproved.

CONCLUSION.

The following tentative conclusions have been arrived at after five months' experience with electronarcosis on a small group of patients :

(1) Electronarcosis is not specific for schizophrenia, but it is a valuable addition to the physical therapies.

(2) Electronarcosis, because of its economy, safety and encouraging results deserves further intensive investigation, particularly in early schizophrenia.

(3) The course of the long-standing schizophrenic disorder is not influenced to any noticeable degree by electronarcosis.

(4) Patients with other mental conditions not responding to E.C.T. should have electronarcosis therapy.

(5) Schizophrenic patients who respond to electronarcosis usually do so between the sixth and fifteenth treatments. This was found to be the usual state of affairs with E.C.T. Patients who do not recover by the fifteenth or twentieth treatment do not benefit by prolonging electronarcosis.

(6) Schizophrenic patients who do not respond to electronarcosis should have the benefit of insulin therapy.

(7) Patients who do not respond to E.C.T. or insulin are more resistant to electronarcosis. This was found to be the case with E.C.T. failures treated with insulin.

(8) No clinical evidence of compression or other fractures was noted with the procedure described. Electro-convulsive therapy, with classical and brief-stimulus techniques, is now given by this method.

(9) Twelve to fifteen electronarcosis treatments and an equal number of shock treatments can be given in three hours by one physician, one graduate nurse and two attendants. A small number of insulin patients can also be supervised during this period.

(10) Electronarcosis is as safe as E.C.T. and safer than insulin therapy.

I would like to express appreciation to Dr. F. H. C. Baugh for his interest and permission to publish this paper, also to Dr. A. L. McKinnon, Dr. G. S. Burton and Dr. M. Bunt for their co-operation in preparing the case material.

Bibliography.

(1) Van Harreveld, A., and Wiersma, C. A. G. (1944–45), *Am. J. Physiol.*, **10**, No. 6.
(2) Tietz, E. B. (1947), *J. Nerv. Ment. Dis.*, **106**, No. 2, August.
(3) Medlicott, R. W., *New Zeal. Med. J.*, **46**, No. 254, 280–297.
(4) Paterson, A. S., and Milligan, N. L. (1947), *Lancet*, August 9, p. 198.
(5) Bowman, Karl M., and Simon, Alexander (1948), *Am. J. Physiol.*, **105**, No. 1, 15–27, July.
(6) Leduc, S. (1902), *Acad. de Sci. Paris*, **135**, 199–200 and **135**, 878–879.
(7) Van Harreveld, A., and Wiersma, C. A. G. (1943), *Am. J. Physiol.*, **139**, 171–177.
(8) *Idem* (1943), *J. Neuropath and Exper. Neurol.*, **2**, 263–276.
(9) Geoghegan, John J. (1947), *J.C.M.A.*, **56**, 15–24.
(10) Medlicott, R. W. (see No. 3 above).
(11) Bowman, Karl M., and Simon, Alexander (see No. 5 above).

A CASE OF HYSTERO-EPILEPSY SUCCESSFULLY TREATED BY DEEP ANALYTIC PSYCHOTHERAPY.

By H. Edelston, M.B., D.P.M.

Introduction.

To estimate the radical change that has come over medicine since the turn of the century it is worth considering for a moment the recently republished classical writings of J. Hughlings Jackson on *Epilepsy and Epileptiform Convulsions*.(1) Extensive and detailed as they are, they contain no hint of a possible psychological approach either to etiology or therapy. Both indeed are specifically rejected, the author taking the greatest pains throughout to keep psychology at a distance, as if it had no place in medicine proper. For instance, he describes most minutely the many and varied mental symptoms associated with epileptic attacks—both those before and those after the attack, when his acute clinical sense often takes him a long way; in his description and discussion of the " intellectual aura " and the " dreamy states " he would seem to be close to some modern views and discoveries.* But for him such symptoms are only aids to diagnosis, mere pointers to underlying structural damage of the central nervous system, which is his only concern—viz. " Admitting that all mental states have parallel physical states I think our direct concern as . . . physicians is with the latter only " (vol. 1, p. 169). He comes to the conclusion that the study of epilepsy with a " psychological habit of mind " is " unfruitful."

It is hardly surprising, then, that he should get no further with the functional epilepsies than purely empirical descriptions, which he himself recognized as an unsatisfactory basis for classification. For he was labouring under the double handicap of a sterile philosophy and an inadequate psychology. His philosophy, psycho-physical parallelism, taught him to keep the physical and the mental in separate watertight compartments, each having no bearing on the other ; and his rejection of the psychological is almost inevitable when we consider the state of psychiatric knowledge in his day. In the absence of a sound *dynamic* psychology it was not possible to deal effectively with the meaning of the psychological factors in the illness itself. The hysterical neuroses, now recognized to be conditions allied to the epilepsies, were for Hughlings Jackson a closed book. Indeed, hysteria is given no more than a passing mention, and then only in a warning not to " mistake epilepsy for hysteria."

Half a century later,† during which time Freud had presented us with his profound and searching psycho-therapeutic technique, in a comprehensive review entitled "Hystero-Epilepsy," Worster-Drought (2) writes: " . . . that it is extremely difficult, in fact almost impracticable, to draw a hard and fast line between hysteria and epilepsy; that is to say, it is scarcely possible to define where hysteria ends and epilepsy begins. This may seem surprising as coming from a neurologist, but the more one studies the two conditions, their mechanisms and probable etiology, the more one is forced to this conclusion." The author goes on to show that between the typical epileptic fit at the one end and the classical hysterical seizure at the other there is a complete range of conditions: "Epileptic variants—which merge from the motor convulsive attack to sensory, visceral and physical manifestations." Moreover, there are "the mixed types—cases which exhibit some variant of epilepsy together with undoubted hysteria. Such cases are much more common than generally supposed and in most of them a diagnosis of epilepsy has been made, and so they continue with their label, all psychoneurotic manifestations being attributed to the epilepsy. These cases justify the term 'hystero-epilepsy.' . . ."

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* *Cf.* p. 338 ff.

† That is half a century after the original publication of Hughlings Jackson's papers. The article of Worster-Drought's appeared at about the same time as their republication in book form.

In continuance of these observations, Worster-Drought asks for the co-operation of the "psychopathologist" (meaning the analytic psychiatrist) in the diagnosis and treatment of all cases of fits where organic lesions have been excluded. For those which are clearly hysterical in origin he admits that the only radical cure is by psychoanalysis. But even in cases of "true" epilepsy "where practicable and in suitable cases I would not hesitate to advise psychoanalytic treatment."

Treatment of a case of any gravity calls for a deep analysis, a time-consuming procedure and one not without its difficulties and dangers, as will be seen later. The problem then for the analytic psychiatrist is to pick out those patients who are likely to reward the time and labour of prolonged psychotherapy. Unfortunately, he has not a great deal to go on in the selection of suitable cases. His own experience is by the nature of things limited, and the literature contains all too few clinical examples either of successes or failures with hystero-epileptics.*

One cannot know enough of the experiences of others in this comparatively new field. For this reason, as well as for its special interest, I am reporting the case below, which after many vicissitudes, at one time being nearly given up in despair, and after more than two-hundred-and-fifty sessions (spread out over two years) finally came through successfully. In presenting the clinical material I have tried to avoid the arid and often controversial psycho-pathological "interpretations" which occupy undue space in analytic journals, but have kept to a plain account of the patient's associations. I have laid more stress on points often glossed over and insufficiently appreciated: on the varying moods and precise emotional quality of the patient's revelations: on the nature and strength of his resistances and the analytic work needed to overcome them: on the corresponding fluctuation of the symptoms and so on. All-in-all I have tried, as far as it is possible to do so for anyone without actual analytic experience, to give a picture of what deep analytic treatment implies in a case like this both for the patient and for the analyst.

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* See later under discussion, p. 397ff.

The Clinical Picture.

The patient, whom we will call A. B—, came with his mother. He was a tall embarrassingly handsome young man, aged 25. His regular features and good looks, of which it transpired later he was only too well aware, were enhanced by his very blond hair and fresh complexion. By occupation a qualified chemist, he had been working away from home for the past four years. But owing to his illness he had been temporarily suspended from his job and was now living at home with his parents.

He found it difficult to formulate his complaint precisely, and I give it as far as possible in his own words. " Articles and thoughts become queer leading to a convulsion and loss of control." He elaborated this further into " mental sensations. . . . An ordinary thought or action would seem different. . . . I can't explain how . . . sensations in the stomach or heart or testes. Thoughts flash through the mind " and he loses consciousness. He feels himself flushing first, then goes pale. To his knowledge there were no convulsions and his unconsciousness lasted only half a minute or so.*

He admitted to symptoms of this kind for about 15 months, before being detected by his superiors. He usually had enough warning to avoid difficult situations and he concocted all sorts of excuses to cover up his slight " absences." He did not fall and had not hurt himself as yet. Unfortunately, as the condition developed he began to drop things during attacks which could now no longer be concealed, and he began to be afraid of going about on this account. Just before coming to see me he was having about four attacks a day of varying severity. He read up the subject in the medical textbooks and came to the conclusion that he was suffering from *petit mal*. But neither his own practitioner nor the medical officer of the firm employing him would commit themselves to a diagnosis and both tentatively suggested an emotional origin for the illness.

There was much in his history and background to suggest a psychological approach to treatment. The patient, who was very articulate, almost loquacious, and very introspective, gave an elaborate account of the gradual development of his illness. First, some two years previously, there were odd fears and general nervousness interfering with his sleeping, but he put this down partly to being on night duty and partly to a love-affair, in consequence of which he did not take adequate rest. Four or five months later he developed spells of " queer lightheadedness " which were rather frightening because things and people and noises had a different significance during a spell, which he insisted was not a fit and not noticeable. About three months later still he began to have *involuntary* fantasies whilst at work. This was a new experience, which really alarmed him. He could not recover the content of the fantasies; all he could tell me was the extremely unpleasant mood that accompanied them. He tried all ways of escaping from them—hard work, heavy exercise, drinking beer, etc., without success. He was beginning to accept them being thankful they were not noticeable, when he had his first definite fit, about a year all told after the earliest nervousness. It was a very unpleasant shock, particularly as a junior colleague saw him in it and he realized what it might lead to.

From this time on he had a succession of fantasies, moods, and fits, irregularly alternating. It was evident from a diary he kept that the moods and the fantasies increasingly gave way to the fits. He wrote at the beginning that he could conceal, but not entirely control his actions in the attacks, but later concealment became more difficult and he dreaded people noticing him. During a holiday at home he had several " living-in-the-past " fantasies, which brought on frightening and unpleasant sensations inside him, followed by " I've been here before: I've seen you before " kind of feeling.

He persisted with all sorts of tricks to keep the fits at bay, or at least bring them under control. At one time he found out he could bring on attacks by thinking of " certain things "; on occasion he had done so deliberately, as he could then be sure of being clear for the next hour or two. Less often he could stop a mood or fantasy materializing or progressing into a fit. He was unfortunately not at all clear as to the methods he used. He did know that excitement brought on attacks, but again he was vaguely non-specific. He confessed at the time I saw him to being continually "scared stiff"; and when near a mood or fantasy he became afraid of the dark or of being alone, "like a little child."

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* Hughlings Jackson gives an uncannily exact description of similar symptoms as diagnostic of epilepsy. (See lectures on the " Diagnosis of Epilepsy " (1), pp. 295–6 ff.)

Family Structure.

The family background was fairly simple. There was his father, "Hail fellow well met—easy to get on with—generous . . ." Mother was a very different proposition; her definite, decisive manner was apparent on first contact, and her character was underlined by the boy's "Mother wears the trousers; she does all the ruling." A brother, C—, two years younger, studying at the University, completed the family. The patient was very proud of his brother's recent academic success, though even in his pride there were twinges of envy that C— had done much better than himself. The sibling jealousy which showed up strongly later was not far from the surface and even at the beginning the patient had more insight on this score than he chose to disclose.

The Course of the Analysis.

The patient began by being extremely co-operative.* He was a good talker and proud of his easy fluency; and of the conquests it allowed of with girls. He was, however, not so self-assured as he had at first seemed, and even in the early stages of the analysis he revealed that his self-conceit was a cover for many weaknesses and feelings of inferiority. He knew his own character well enough and he elaborated it as follows:

He condemned himself for being self-centred and vain; he admitted he could never be sincere and that all his life he had been acting and posing. His affairs with girls, he explained, were partly a piece of bravado to overcome his early shyness, and partly to satisfy his vanity. There was also a feeling of revenge on women, a theme which became very significant later on. He described a period of extreme narcissism round about puberty, when he became an effeminate dandy for a time. Even now "I've made my body a god and I can't bear anything wrong with it." It hurt him to think he was not fit to join the army (on account of his fits).

He kept calling himself a coward: "I take the easiest way out—am always putting things off—I wouldn't work" (at school) and only did so in later years out of jealousy of brother C—, who at one stage had caught up with him and passed him. He commented bitterly "C— was a paragon of all the virtues."

He has had various irrational fears since childhood, and very much dislikes being alone or in the dark. On that account he has been very much fastened to his parents. Yet he resents their advice and "interference" as encroaching on his independence; his early years would appear to have been one long clash with his mother who was as headstrong as himself. More than once he ran away from home, but soon came scuttering back. He remembers enjoying the worry it caused them at home!

There were many ambivalences indicative of his many conflicts. His alternation between self-depreciation and a terrific conceit; his protest of being (or wanting to be) aggressively independent yet craving for the approval of others. He had tried hard to break away from his mother's apron strings, but failed owing to his fears and other anxieties; even early in the analysis he "almost hated" his mother for his dependence on her. A similar conflict about his brother C— took the form of a conscious admiration of C—'s achievements and an imitation of his opinions, with an undercurrent all the time of jealousy and antagonism and rivalry. He violently condemned his own posing and self-pity without however having the strength to alter either.

Several times he had a fit during analytic sessions, when the severe ones were seen to approximate to major epilepsy; a similar development at home not unnaturally alarmed his parents. The fit would begin with a marked change of expression when his normally pleasant smile gave way to a very ugly look; then followed coarse clonic movements, but only of the upper half of the body; mostly of the arms and head. If he were standing at the time he half slipped slowly to the ground; there was no heavy fall, as is usual with the epileptic. The loss of consciousness was only brief and he was soon himself again. The whole attack lasted no more than a minute or so.

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* He came three times a week as a rule for hourly sessions.

About the twentieth session, following his first marked resistances, he brought out very guilt-laden sexual reminiscences of his puberty and adolescence; how he had been taught to masturbate at thirteen by a pal; how he and several other boys, in a gang, made all sorts of homosexual experiments, both active and passive, of which he was very ashamed. He had found, to his alarm, that he became more and more sensual as he grew into adolescence, and at about sixteen he began to be afraid of becoming "a sexual maniac."

With girls his sexual behaviour at this time had taken a significant turn. Their attention flattered him and ministered to his pride and vanity. Whereas up to now he had been shy and retiring, he began to get "an aggressive kick out of overpowering a female sexually." There was no feeling for the woman, and actually some pleasure on leaving her "high and dry." He was very proud of his "breast play" in particular, and he confessed that this gave him as much or even more satisfaction than anything else. For him sex was power, power over women, and he gloated over the advantage that his handsome good looks gave him with the girls. He was particularly pleased when a girl showed herself keen on him and he kept her at a distance.

He went on working through various themes in alternation. Sometimes a session full of his fears and loneliness and unhappiness at school, where he neglected his work and did very badly. Then sessions with increasing ambivalences towards his mother; how she fussed over him and spoiled him and how he liked it; and yet sequence after sequence of the clash between them, and her harsh punishments. At one stage he went over a phase of stealing money from her handbag; and after discovering how he upset his mother by his misbehaviour he developed a technique of "You make my life a burden and I'll make yours." He remembered tantalizing his mother into saying "I wish you'd never been born," and his tart reply, "I never asked to be." Into this situation C— gradually intruded, becoming everything that the patient was not. The continual comparisons made the patient violently jealous; he felt himself being pushed out, and more and more of an outcast.

About the fortieth session he became completely dissociated at times on the couch (almost self-hypnotized) and he brought up deeper and deeper material. There were numerous and varied fantasies of himself at his mother's breasts, the whole picture with a strong sexual colouring. Even here the power element intruded, for he found out "It gave mother pleasure too," and that was his hold over her. He brought up the discovery at a very early age that he could always get round his mother by being ill: "Then she was very nice to me, just perfect." Unfortunately one of his illnesses was scarlet fever, which meant removal from home, and he went through the awful feelings when taken away from her to the fever hospital.*

Hereabouts he began to develop decidedly negative transference feelings towards the analyst, which took the form of elaborate and circumlocutory criticism of the medical profession. He became jealous of doctors' superior status and training to pharmacists. He criticized the average doctor's ignorance of galenicals, and in dreams and fantasies he brought up pictures of the psychiatrist or other doctor asking *him* about pharmaceutical matters in which he showed his superior knowledge. He alternated between asking to be "told off for being such a dirty dog" and pleading that one should be nice to him. His free associations began to drag and one could feel the resistances increasing. He was unable to relax so easily on the couch. He expressed a fear of being thought epileptic or insane and treatment abandoned in consequence. This led on to a long series of fears; of someone going to attack him and of helpless feelings of being trapped. His dreams were of being chased by murderous people.

His resistances went on increasing all round. There was a certain amount of consolidation of previous material; for instance, he elaborated his deep sexual fantasies to the extent of connecting the breast pictures with incestuous feelings towards his mother and he filled in a great deal of detail with regard to his brother. But all-in-all there did not seem to be a great deal of progress. There was no doubt about his negative attitude to the analysis in his sceptical replies to even simple interpretation. He evaded at times by doubting the validity of his own associations.

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* See Edelston: "Separation Anxiety in Young Children A study of Hospital cases."

Unfortunately, but as might have been expected, his symptoms at this time became much worse. He was having major fits—and frequently, though still by far the most usual kind was the minor attack for which he first came to me. The major fits were more severe and the subsequent dazed confusion lasted longer. More than once he reported having bitten his tongue, and as time went on this became quite usual. There was also a greater tendency to fall more heavily and hurt himself; once he came with his face all bruised where he had cracked his chin on the ground in a fit.*

His temper at home ran *pari passu* with his resistances in the analysis, and his parents worried and questioned: Was the analysis proceeding satisfactorily? How long would it be before he would show some improvement? Was he really a psychological case or did he have some organic epilepsy? And so on.

In the analysis things went from bad to worse. So meagre was the analytic material, and so strong his resistances, that in an attempt to force the pace I resorted to a hypno-analytic technique with direct association on some of his outstanding fears as enumerated above. Some of them—the fear of being attacked and the fear of being trapped and helpless—he brought up with almost hallucinatory vividness, though without much apparent effect on his general condition. For correspondingly he lost some of his insight. He came out with strong feelings that mother didn't want him: "C— was the favourite because he gave in to her. Mother only put up with me because she had to." From that he developed notions that everyone was against him and had been so from the beginning. He even included the analyst, though he was not too sure of this.

With his condition steadily deteriorating (his father sent me a long list of his major fits over a short period) and the analysis stagnating, I sent him to a colleague who was a good hypnotist, for relaxation treatment with suggestion under hypnosis. The attempt failed completely; there was no adequate relaxation, he was found impossible to hypnotize, and not unnaturally, suggestion did not affect him. After about ten sessions he made his way back to me of his own accord to continue his analysis, with the most interesting results and a complete resolution of his symptoms.

Second Period of Treatment.

He started off the second series with two confessions. He admitted he was not associating completely freely for fear of what I would think; and in a session devoted entirely to a discussion of his resistances he revealed that he had been hoping for the past *months* that he would be able to be cured without tackling some of his fantasies. One particular set of associations he was holding back were those brought up by the word "hate" in apposition to C— and mother. His second admission was an expression in detail of the secondary gain from his illness: "It is so nice being ill; gets you all the attention you want; gets you sympathy" and at the same time "a subtle revenge on mother!"

One immediate result was a period of freedom from fits of about three days, which he then made up for by having a bad fit in the street. He was so dazed and confused after it that he had to be picked up by the ambulance and taken to hospital. He came round some four hours later and was furious at what he considered a most humiliating experience. There was about this time a longer period of unconsciousness, generally after attacks, in which he performed some sort of automatism, the meaning of which was not clear.

Now began a new phase. During one session on the couch he said he heard an explosion like a pistol shot outside in the distance. On this as on other similar occasions later, he was clearly completely dissociated and hallucinated. Yet he had insight. He recognized his dissociated state and talked of a second personality, A. B— No. 2, laughing at him. The situation for him was sinister and dangerous, and he elaborated through many sessions his fears and helplessness in the face of A. B— No. 2. On one occasion he had a fugue lasting half an hour on his way to treatment. His initial fantasy was of "stepping out of myself—and directing myself from behind—silent—remarks sounded different—directing my arms from inside like a machine. Brilliant light—sinister—father's expression knowing." (He could get no further than this.) Yet in his inevitable ambivalent way he had to admit that (at the same level) there was an attraction in being helpless: "It paid me to be helpless—got things done for me."

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* *Cf.* the general teaching that hysterics do not bite the tongue or hurt themselves and that this is an important point in differential diagnosis.

From here, after a few badly blocked sessions, he worked up to a violently hostile transference which proved to be the turning point of the analysis. He was worried in one session about a mildly critical remark he had made previously. He put up a tremendous argumentative resistance to developing associations on the situation, which in the end brought out a number of filthily abusive comments on the psychiatrist's personal background. He had to admit also to many criticisms of the analysis and the analyst in which he alternately defied and derided the latter, then was scared of possible consequences: "Sometimes I feel you're almost a huckster. I think you are holding me on a piece of string and not helping me for what I said. . . ." "You'll get your own back—and when I'm broke you'll turn round and say I should be in a mental home." He gave me himself one origin of this antagonism: "A craving for the attention I never had as a youth—I want to be somebody—jealous of brother" and his educational success; from which derived a similar jealousy of the psychiatrist's superior education and status (hence his derisive criticisms above). His great desire, he explained, was for power over people and that they should look up to him—"I want people—everyone—to think well of me—I want you (analyst) to say I've got brains."

His final comments on this critical session were very pertinent. "I feel cleaner inside—I've broken into A. B— No. 2—but he'll get his own back later." Which "he" did; for after eight days' freedom from fits (the longest period so far) he had a really violent one to make up for it.

After this the analysis proceeded apace, though not without its ups and downs. Some of his associations took him to very deep levels, with breast fantasies in which he could "smell it, taste it, breathe it, everything but see it." There were sexual elements in the fantasies, but these did not become explicit till later. Interesting was the disclosure (after over a year's analysis!) that in the first place he accepted treatment only to please his parents; that he was not impressed by the psychiatrist and had put up conscious resistances for some months. Immediately following this he resumed his old theme of getting his own back on women; a significant connection when one learned that it was his mother who all along was pressing for the analysis to be continued to the end.

Now he brought up and worked through frankly incestuous sexual material. He exposed and laid bare his repressed sexual attachment to his mother. Father he dismissed contemptuously: "Father's no use to her—she enjoys bathing me because she gets no satisfaction out of him, so she gets it out of me—I've a big penis, etc." This gave him power over her "in a psychological manner." It gave him an advantage over C—, too, who "wasn't half my size (sexually)." He linked this directly to his earlier confessions about his attitude to girls during adolescence (see p.)—"I do enjoy power over women—when they fall for me I throw them aside—young girls did that to me when I was younger—now I can do that to them."*

It was not an uncomplicated picture; it was associated with so much guilty fear that he tried to reject it. Again and again after elaboration of his sexual power fantasies he had a feeling he would have to "pay" for it. It amounted at times to a "feeling of persecution—of being set on by somebody," similar to the unpleasant persecutory elements in the fit.†

He elaborated these themes and their corollaries in detail over many sessions, slowly but surely narrowing the field of origin and localizing it to mother. He had "vague upsurgings of hatred towards her" which steadily crystallized into a massive ambivalence on the following lines:

There were always rows with mother when she tried to dominate him. She was a protection and a help, but "You always had to do everything she wanted." It was always easiest to agree: "Yes mother," but with reservations. He had two pictures of mother: "One I'd like to punch—the other a 'Yes love' mood." On the one hand she nagged, on the other she helped. She grumbled and punished, but she always did things for us. He was afraid of "pulling mother to pieces": a voice inside saying "getting own back later." He was surprised to find in real life that as he kept on blaming mother it led to his loving her more, in his present-day relations.

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* This equation, Sex = Power, I find is a common theme at quite a deep level in the analysis of severe cases of hysteria.

† *Cf.* also the same element in the main negative transference (p. 393).

He developed his associations, reproducing similar ambivalences at deeper and deeper levels: "It is so nice being helpless and carried about: (then defiantly) "She enjoyed it too! . . . I'm afraid she'll stop doing it—But I know motherly love will prevail . . ." "She's so changeable—you never know when you've got her—she'll turn round and tell me to rely on myself—mother's revenge would be to stop carrying me about!" He had a flash of fantasy that it was mother getting her own back in his fits—"at the worst possible moment."

Now he came back to his envy of his younger brother C—. He rapidly unearthed a sibling jealousy at a very deep level (presumably the same level as he had been working on with mother). There were many details of his hostility worked out on the way, one memory being particularly significant in that it was connected with his incestuous sex and breast feelings:

> "C— breast feeding . . . I pushed 'it' away ('or did I punch mother?'). . . . Mother has a contented look when feeding him. . . . I didn't like that. . . . Mother likes *me* playing with her breasts."

The climax came in a dream "that I killed C—. I went into his bedroom—he seemed a lot smaller than me (he isn't now)—asked him—he answered back—I beat him up—smashed his face in."*

Having disposed as it were of C—, he took up again the complications of his incestuous attachment to his mother. Over many sessions he worked through the various elements, sometimes by direct reproductions of infantile experience or fantasy, sometimes via transference situations with the psychiatrist.† The emergent pattern was quite complex and can hardly be given in any detail, but I should like to mention the main conflicting drives and how they were woven into it.

The sexual was there from the beginning and coloured much if not most of his fantasy at all levels, with corresponding guilt on the usual conventional lines. There was the plainly genital. As it came to the surface towards the end of the analysis it gave rise to *conscious* desires to rape his mother, momentary but intense, which in the sequel, as I shall have occasion to relate, became quite terrifying. The pregenital were mainly oral, with the elaboration of the breast pictures previously described. At different stages they were associated variously with his jealousy of C— (v.s.) and more violently with the clash of wills with his mother, with misbehaviour and correction or punishment.

The power conflict as already noted was a very violent one, with deep roots and wide repercussions. Many times he repeated how he hated women having power over men. He wanted to humble mother. The only way was through sex (and via all other women)—"I'd like to see her hurt and her pride upset," a formula he repeated with greater and greater venom in different ways and in different contexts again and again. But accompanying this desire was the deeper fear, the fear of being disowned and rejected. At the breast level in one very productive session it came out like this:

> He had a dream, "Of me of to-day but mother of a long time ago. I was having a bath; seeing through mirror mother naked—non-sexual—just beautiful like Venus—telling her—no fuss—she started bathing me—almost like reassuring sex education." Amongst the associations: "See myself in mother's arms—I try to get her breasts—she pulls away—I hit her—she puts me down—I'm afraid." Then came his paramount need of mother: "How I needed her—she was part of me—but she changes—I hate her but I can't kill her like C—, I need her but not him—If mother died where should I be?"

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* This was not the end of C— in the analysis, but the dream and the abreaction of its associations cleared the field so that later revivals of the hostility came up more directly and easily. The deepest ones were of C— at mother's breast, the patient fighting to push him away, with the inevitable reprimand from mother.

† Hadfield's direct reductive technique was the method used here. Transference feelings are pointed out and isolated as soon as they arise, and used as a starting point for free associations ("When did you feel like that before?"), to refer them to their real origin. In this way interpretation is reduced to a minimum and much material of direct historic experience is exposed and developed.

He himself summed up: "I've never hated anyone as much as mother and I've never needed anyone as much."

(It was about this time he gained great advances in insight: "I'm just realizing what a little b—— I was when young—up to now blaming mother; now I realise myself largely to blame—the only person I really love is myself. Wondering if I'll ever be forgiven.")

The fear of losing mother gave point to his conflicts over independence. He so badly wanted to stand on his own feet, and fought hard against the revelation of his deep desire to be helpless so that she would fuss him and nurse him. At bottom there was a pleasant, almost affectionate desire to be babied by her:

> "Feeling towards mother not a raping kind, but a lovable kind of feeling—(he began to cry in spite of an attempt to suppress the tears)—It doesn't seem wrong when I put it back as a kiddy, but to feel it NOW!—I should have loved to sink back in her arms and be a baby again. . . ." He explained that was different altogether from the sex feelings, even though it came up in connection with them.

An offshoot of this desire was a revival of his complex about C—. "I can't have her now *he's* there—She isn't mine for the asking: She doesn't come when I cry—fancy her daring to have another baby—etc.

He reported that he did not lose himself so completely in his fits and he could feel himself invaded by very unpleasant fears, which he symbolized in all sorts of ways. More and more there entered "punishment feelings"—"Of being paid back," and as time went on he talked of "a self-punishing mechanism." Very often in his sessions, after a particularly guilty self-revelation, he would add "You'll have to suffer for that"— or "A. B— No 2 will pay you back for it later with a fit." The fits took the form of "punishments, humiliations self imposed." There was some satisfaction in that "I like being punished—makes me free—lets me out," exactly as "If mother accuses me of doing wrong that makes it right." But he complained that his own punishments were too severe.

(Clinically he was better in that he was having spells of freedom from fits of several days at a time, though he was proving argumentatively difficult in his behaviour at home. In the hope of circumventing his "temper and heroics" (his own words) he took a job, but had to give it up after three days owing to a bad fit.)

Events rapidly moved to a climax as his self-condemnation increased. The urge to attack mother sexually becoming stronger and more conscious, the more intense and violent were the punishment fantasies. He had a last fling at the psychiatrist with a compulsive desire to tell him off for suggesting he was responding to treatment*—"He won't bully me—I'll see he doesn't." He had dreams of "tough guy feelings" and of "lashing out." There was apparently rather more quarrelling at home than usual ("F's awkward mood and mother's tears") and he condemned himself for being "a liar, two-faced and sensuous, etc. . . ." He had a picture of "the invisible enemy closing in on me."

He came to one session in a highly emotional state. He began by saying that he had told his mother everything, "everything about the analysis." She, it seems, took it very well. He described himself as crying like a little baby as he confessed in his mother's arms. He kept emphasizing again and again the enormous upheaval of the experience. At one time he thought he was going mad. "Like a ball of fire in your brain—taking part of your mind away—putting in your hand and pulling something out. It was the fantasies coming to life." But it was a marvellous feeling leaving you "cleared out" and free from fits. He was on the couch free-associating in the usual way. As he did so he became more and more obviously excited. He condemned himself as a miserable swine for doubting either the psychiatrist or his mother, and then mounted into rhapsodies of both, chiefly of his mother, threatening violently anyone who might interfere. He worked himself up to such a pitch that he had to sit up and ask for a drink. He still went on talking, however, and now it was seen that he had quite lost control of himself. He alternated silly laughter with tears in a hysterical manner. He kept slapping himself on the forehead saying "What a fool I've been, what a fool I've been." He was all but inaccessible, though fortunately fairly docile and in good humour. (On his way down to the waiting room he offered the caretaker ten shillings and told him how good everyone was to him, etc.)

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* This was the patient's fantasy, not the psychiatrist's opinion.

This mild but undoubtedly psychotic manic state lasted about three hours after being called for and taken home. When seen two days later he explained, "Everything I did I felt better for it—I felt A. B— No. 2 leaving me." He had been near suicide before his confession to mother; now has "this marvellous feeling of getting rid of A. B— No. 2." He had been getting rid of No. 2 in bits, but now felt it leave his stomach and body altogether.

This proved to be the virtual end of the analysis* and the patient's prognosis that he had got rid of No. 2 was quite correct. He had no further fits from this time on, though he reported once that he had been near a minor attack "but there was no force behind it." In conversation just before finishing he recognized the relationship between his mother-fantasies and the girls he went with. He remembered his mother's image being actually present at one time "both as the object of my sex desires and the prohibitor stood behind me." He described a pleasurable element in his fits "so long as they were not showing me up." The unpleasant part of it all was the humiliation which constituted his punishment, almost self-punishment. His final summing up of his fits as "a dramatized self-punishment" was particularly apt.

I heard from him a year later, when he wrote: "I have had no reactions of any kind. My weight is approaching its original figure and my nerves, sleep and digestion likewise as before my illness. . . . I suppose my reactions and sentiments towards my mother are of most importance and all I can say now is that if I picture her in my mind's eye for a minute or two, tears come into my eyes, no matter what mood I'm in. When face to face we soon disagree, but no beastliness on my side, tolerance being something I'm slowly learning. Maybe being on the verge of tears is the long suppressed deep-rooted sentiment towards her and the last relics (if any) of my self-punishment. I enjoy these tears, as it drives home what a contrary so-and-so I've been,"

A year later still he was in the neighbourhood in connection with his impending marriage and he called to see me. The change in him was very striking. He had filled in and was several stones heavier than when under treatment. There was no sign of the fits and no doubt as to the completeness of the cure.

My last information about him came from his mother very recently, nearly six years after the conclusion of treatment. Relations between her and her son had become strained since he had married, about three years after the end of the analysis. She blamed his wife for the estrangement, which distressed her even to talk of.† About his fits: He had no sign of them whatever up to the time of his marriage. The following year he had "Some sort of slight attack during the night after an awkward day," but that was all. He had been working regularly and continuously throughout the years and has done very well for himself in his profession.

DISCUSSION.

I have already commented in my introduction on the self-limiting approach of Hughlings Jackson to the problem of epilepsy, which is still for the most part that of traditional medicine to-day. For instance Penfield and Erickson (3) in their recent elaborate monograph on the subject put all the emphasis on the physical aspects of the disease. Indeed their definition of epilepsy in terms of "abnormal excessive neuronal discharge" entirely begs the question and prejudices the issue in advance. Such "psychological studies" as they describe are limited to one chapter only, and prove to be nothing more than simple surface descriptions of behaviour problems which are mainly the *secondary*

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* He went on attending for a short time longer. There was still material relating to C— to be cleared—*cf.* "I've paid the price for mother but I've still to pay for C.—" But this did not bother him much, and as soon as it was seen that the fits had gone he was anxious to end the treatment and be off working.

† For this reason she did not want me to see him personally and refused to give me his address.

consequences of the disease. Their "psychotherapy," in consequence, is entirely restricted to external manipulations of a social and educational character—management, rather than therapy, in the real sense of the term.* The authors show no conception of deep *inner* mental conflict in their pathology, and in fact, specifically reject psychogenesis as a possible aetiology. It is very significant that the term hystero-epilepsy does not appear in the book at all.

By contrast one has the refreshingly progressive views of Worster-Drought previously quoted.† In spite of this neurologist's opinion "that it is extremely difficult, almost impracticable, to draw a hard and fast line between epilepsy and hysteria" (because of the continuous series between extreme examples of each) attempts are still being made to find a basis for a clear-cut differential diagnosis, so far without success.‡ A truly psycho-physical approach as suggested by Worster-Drought would reveal the barren futility of these attempts. The psychological and the physical interpenetrate and interact throughout, though the nature and extent of the interaction must vary considerably at different levels. From which angle one should attack any particular case in therapy will depend on an assessment of the psychological and physical components in the pathology of the disorder. The practical problem for the analyst then becomes the accessibility or otherwise of the psychological content, and the possibility of its reduction and elimination.

The above considerations become the more convincing when they are supported by an undoubted therapeutic success, such as the case given in detail here. Unfortunately, there are all too few examples reported in the literature, but the following corroborate and confirm my own experience.

Dicks (4) gives a case diagnosed as hystero-epilepsy which has so much in common with my patient that a summary of it is worth quoting here. (The italics are mine to bring out the resemblances.)

> "A very tall and powerfully built girl of 19, *with the face of a baby* . . . was sent for the treatment of epileptiform fits from which she had suffered from the age of 15. . . . There was no family history of any fits or other neuropathic or psychopathic illness. The girl was suspected of having a pituitary lesion, but investigations revealed no abnormality.
>
> "The fits would commence with loss of consciousness with a cry, which *followed some hours of change of mood. They would often be tonic, sometimes tonic-clonic, at other times quasi purposive.* From time to time she would *wet herself and bite her tongue* (in the fits). They were *unaffected by sedatives* like bromide and luminal. She was treated analytically at first and revealed the following story:
>
> (Here follows details of her great attachment to her father, now dead, and her rebellious antagonism to her mother. Also, of an early puberty, "which has made her the victim of many indecent assaults," one particularly at 12, when she had been seriously assaulted by a boy in a barn and had fainted.)
>
> "One day after getting into trouble (at work) she had her first fit. She admitted now that *sometimes she did not become unconscious, but was aware of all around her but unable to initiate or control her movements.* As the fits recurred at her work she was removed and lived at home, visiting her father's grave daily, and at times having *hallucinations of him calling her* to join him.
>
> As an experiment she was hypnotized one day and duly *went into a dissociated*

---

* There being no attempt at radical cure, only to help the patient to adapt himself to the *consequences* of his fits.

† Page 389.

‡ *Cf.* Parfitt, "Epilepsy and Hysteria," *Lancet*, 1947. See also Penfield and Erickson, p. 445. The EEG does not appear to be of great assistance in the borderline case.

state when she became flushed and rigid. She was commanded to recall what she was experiencing and awakened. She related with great horror that she went through the scene of the assault with the boy in the barn, and that *his face then changed to that of her father*. She was given reassuring interpretation, but failed to keep further appointments. It was ascertained later that she had *become very excited and intractable and had to be admitted to a mental hospital for a few weeks*. She made a rapid recovery and from that time has been free of fits and apparently well according to follow-ups over three years."

Allowing for the difference in sex the parallel is particularly close, and, like my own case " offers a valuable commentary on the importance of a psychological approach to epilepsy even when the fits seem to conform to type . . . ."

The other case, presented in some detail by Berg (5), is that of an aggressive man, aged 45, suffering from " occasional fits—either idiopathic or psychogenic." He was taken on for analysis. The account given of the analysis (length of treatment not stated) shows a release of the usual sexual and aggressive material with considerable benefit to the patient. Berg concludes : " The reduction almost to vanishing point of the epileptic fits (he has had only one in two years), and the advent of conscious hysterical attacks as a substitute, would indicate that in this case at least, there is a relationship between the sources and mechanisms of epilepsy and those of hysteria."

(I have one other case, communicated to me privately, of a girl aged 20, suffering from fainting fits diagnosed variously as " idiopathic epilepsy " and " hystero-epilepsy." She was treated analytically by a colleague with a good result. Unfortunately, the records of the case are incomplete and do not include a follow-up.)

Considering the magnitude and importance of the problem of epilepsy, it has hardly been seriously studied yet by the methods of analytic psychiatry. Schilder (6) is more interested in its bearings on psychopathological theory, but he has one or two pertinent comments on the psychological approach. For instance, he states that he " was able to clear up amnesias which occurred during the epileptic twilight state by means of hypnosis " in very much the same way as with hysterical twilight states, and considers that " a similar situation is to be found in the hypnotic subject." The key to the difference lies in " the epileptic apart from his seizures," and should be found in a study of the epileptic personality, noting that (at the time of writing) " we are still lacking more thoroughgoing analysis (of epileptics)."

According to Henderson and Gillespie (7), " Certain mental symptoms generally found in a confirmed epileptic constitute what has been called the ' epileptic character.' For a long time the epileptic character was looked upon as secondary to the ' disease,' i.e. the fits. It is now recognized that the traits constituting the epileptic character can often be shown to have existed before the fits began. It is now held in fact by many that there is a characteristic epileptic make up, in which alone the disorder called 'epilepsy' develops. . . ."

A study of the various qualities listed under the heading of " The epileptic character " shows in the first place some common to those of the neuropath generally ; for instance, undue sensitiveness and egocentricity. There are others, like his well known bigoted religiosity, more peculiar to the epileptic. Amongst the latter are many which in sum bear a suggestive resemblance to the make-up of the severe hysteric. Take the autoerotism and narcissism, or, as Schilder put it, " a special love of oneself and an extraordinary vanity," couple it with the shallowness and desire for praise noted by Henderson and Gillespie, and one has a character complex which is very prominent in the hysterical neuroses.

Schilder further points out contradictions in the epileptic's mental make-up, what we should now call ambivalences. He refers in this connection to the views of Stekel, whose work has not received the appreciation it deserves.

As far back as 1910 Stekel (8) wrote on the psychological treatment of epilepsy. He summarized his conclusions as follows :

(1) Epilepsy is frequently a malady of psychological origin.

(2) In every case there exists strong criminal tendencies rejected by the conscience. . . . .

3. The epileptic fit is a substitute for the crime, possibly a sexual act looked upon as a crime. . . . .

(4) The fit is often caused by the fear of divine punishment and symbolizes guilt, punishment and death.

(5) " Pseudo-epilepsie "* is curable by psychotherapy. It demands long-continued treatment because the dissociation of the personality is already well advanced.

Allowing for a slight extravagance of language, all of these theses are well substantiated by the material quoted here.

In a later article (9), dated 1937, Stekel referred to the already mentioned difficulty of drawing any hard and fast line between " true " epilepsy and hysterical attacks. He discusses the so-called epileptic character and notes its essential affinity with that of the neuropath in general. In his opinion the peculiarity of the epileptic lies in the all-pervading violence of his hatreds, which set up inner conflicts of a particular severity only to be dealt with by deep dissociation of the personality. The fit then represents a spasmodic reappearance of the repressed half of the dissociation, very much like the same phenomenon in the dissociated personality of the hysteric. The difference between the two would lie in the nature of the repressed material and the the severity and depth of the repression. In hysteria the division of the personality is at a comparatively high level and the dissociation not so profound. With the epileptic, on the other hand, all the indications are of a regression in the fit to very deep layers of the psyche.† The contrast between the near-normal behaviour of a hysterical outburst, or a fugue, and the primitive violence of an epileptic fit would point to some measure of the difference.

Dicks (4) implies the same thing when he says, " There would appear to be every graduation in the severity of the dissociation from the tantrum to the true " idiopathic " attack. It has seemed to me that the nearer the true epileptic attack the manifestations are, the more primitive aggression is present, so that idiopathic epilepsy may, after all, be a regression to the massive tension-discharge of infantile rage."

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* This is the expression used in both the articles quoted, the one in French and the other in German. From the text it is clear that he includes under this heading those cases classified in this paper as hystero-epilepsy.

† Schilder quotes Stekel as saying that " One always deals in the epileptic attack with a flight from reality, or with the living out of an impulse. The attack may repeat the scene of the patient's birth or carry him back into embryonal existence. The epileptic may experience in the attack his own death, or he may commit a forbidden sexual act or actual crime during the attack."

The problem then in *radical* therapy is the release and reintegration of these lost impulses, principally deep hatreds and very infantile sexual desires. There is increasing experience of this kind being successfully achieved by deep analyses, which I agree with Stekel are difficult and protracted on account of the depth of the dissociation and the rigid nature of the epileptic personality. But I think he is far too optimistic when he gives three to six months for the duration of treatment ; one to two years or even more (i.e. something of the order of 200 sessions) is much nearer the mark.

In view of the length of treatment and the demands it makes both on the analyst and the patient, it would be as well if we could develop diagnostic criteria whereby we might assess in advance whether deep analysis is feasible and likely to be successful. As already advanced, the essential psychopathology is a deep mental dissociation and repression with the spasmodic reappearance of the repressed during a period of unconsciousness (i.e. only with the ego out of action). This gives a line on the importance of the normal character of the patient in estimating the advisablity of analytic treatment. For inasmuch as the repressed material is unacceptable to the ego, it must be particularly violent in those patients showing the more vicious aspects of the epileptic character. In the milder hystero-epileptic it is bad enough ; in the brutal epileptic it must be quite impossible, and best left severely alone. If, in addition, one bears in mind that massive infantile rages, etc., are deeply buried in the unconscious and correspondingly difficult of access, it can easily be seen that there comes a point when analytic psychotherapy is impossible as well as inadvisable. For such patients the aim of treatment will be just the opposite to that of analysis. One would seek to increase the repressions and/or reduce mental tension generally ; objects generally achieved by the exhibition of the various sedative drugs used so much in epilepsy.

There is, then, great need for more reports of analytic experience, successful and otherwise, with the various kinds of epileptic, so that in time we will be able to differentiate out from the mass of material those patients who will safely repay the time and effort of protracted analytic psychotherapy.

SUMMARY.

1. The author supports the view that epilepsy and hysteria are extreme ends of a continuous series with an intermediate connecting group known as hystero-epilepsy.

2. A psychological attack on the problem of hystero-epilepsy is recommended.

3. Details are given of the successful treatment of a case in a young man by deep analysis which took about 250 sessions spread over two years.

4. In discussing the result, the self-limiting nature of the purely physical approach to the problem of epilepsy is criticised.

5. From the case given and other cases quoted from the literature, a psychopathology of epilepsy is put forward showing its affinity, with other psychoneuroses, hysteria in particular.

6. Comment is made on the limitations of analytic psychotherapy and a request for more reports of cases to help to define these limitations more closely.

REFERENCES.

(1) *Selected writings of John Hughlings Jackson.* Ed. James Taylor. Vol. I: *On Epilepsy and Epileptiform Convulsions.*
(2) WORSTER-DROUGHT (1943), *Brit. J. Med. Psychol.*, **14**, 50.
(3) PENFIELD and ERICKSON (1942), *Epilepsy and Cortical Localization.*
(4) DICKS (1939), *Clinical Studies in Psychopathology.*
(5) BERG (1941), " Clinical Notes on a Case Diagnosed as Epilepsy," *Brit. J. Med. Psychol.*
(6) SCHILDER (1928), *Psycho-analytic Psychiatry.* Nervous and Mental Disease Monographs.
(7) HENDERSON and GILLESPIE (1941), *Text-book of Psychiatry.* 5th edition.
(8) STEKEL, W., *Zentralblatt. f. Psychanalyse*, Bd. 1, 220.
(9) *Idem, Bull. Med.*

CLINICO-ANATOMICAL STUDIES OF FRONTAL LOBE FUNCTION BASED ON LEUCOTOMY MATERIAL.*

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The present paper is based upon the investigation of 95 brains of patients dying some time after leucotomy, and mainly, though not exclusively, upon the 45 cases in which the survival period was more than 5 months (up to 5 years). In a third of the total material and in about half of the 45 cases with survival longer than 5 months a full microscopical investigation has been carried out or is nearing completion. Eventually all the informative cases will have been so examined, but investigation by serial sections of considerable parts of the brain is a time-consuming undertaking. An unfortunately irremediable defect in our material is the unevenness and incompleteness of the clinical, physiological and psychological investigations of the patients. Obviously only limited correlation studies can be carried out on such material. Again, the number of fully recovered cases in our material is small, in fact only some four (Nos. 66, 71, 10 and 18) of the total could be classed as such. The reason for this is that fully recovered patients are likely to die from intercurrent disease outside mental hospitals, when it is difficult to procure a post-mortem.

The frontal cortex is customarily subdivided into a granular and an agranular portion. The main agranular cortex, called areas 6 and 4 by Brodmann (Fig. 5), constitutes the premotor and motor regions, which do not concern us directly in this paper. We are concerned with the prefrontal region or frontal association area, which has been subdivided by Brodmann into areas 8, 9, 10, 11, 12, 45, 46 and 47. All these are granular except perhaps part of 8 and of the posterior third of the ventral (orbital) surface, which are agranular. Walker (1940) has recently differentiated posterior parts from the rest of the orbital region in monkeys as areas 13 and 14, and the human homologues of these areas have been defined by Beck (unpublished), working in this laboratory. Fig. 1 has been kindly supplied by Mrs. Beck to illustrate the position of these areas in the human brain. These two regions are important because, as has been shown recently, they are concerned with autonomic function, and bilateral ablation of area 13 leads in monkeys to severe restlessness. Autonomic control seems also to be exercised by the anterior cingular region (area 24), which, though not part of the prefrontal region, may be involved in the usual cut. In front of it on the medial surface is area 32, which is part of the cingular belt, and apparently a nodal point of considerable physiological activity between cortex and subcortical basal ganglia.

The prefrontal region has many connections with other parts of the brain, and much of the work in our department is concerned with investigation into

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* This paper was read on 26 July, 1948, at the International Congress of Psychology in Edinburgh.

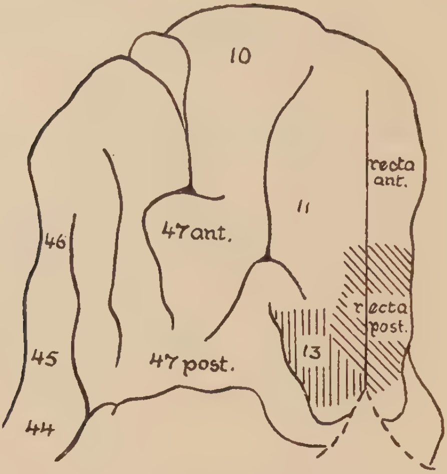

FIG. 1.—Position of Walker's area 13 in the human brain. Topographically area recta posterior roughly corresponds to area 14, but it is cytoarchitecturally not homologous.

their still very considerable obscurities. Such purely anatomical matters will not be dealt with here except to stress the important connection of the frontal lobe, firstly, with the thalamus, which relays most sensory impulses coming from the periphery, and secondly, through the thalamus, with the hypothalamus, which is known to be an important control station of metabolism and, in particular, of autonomic function (Fig. 2). It has actually been suggested recently

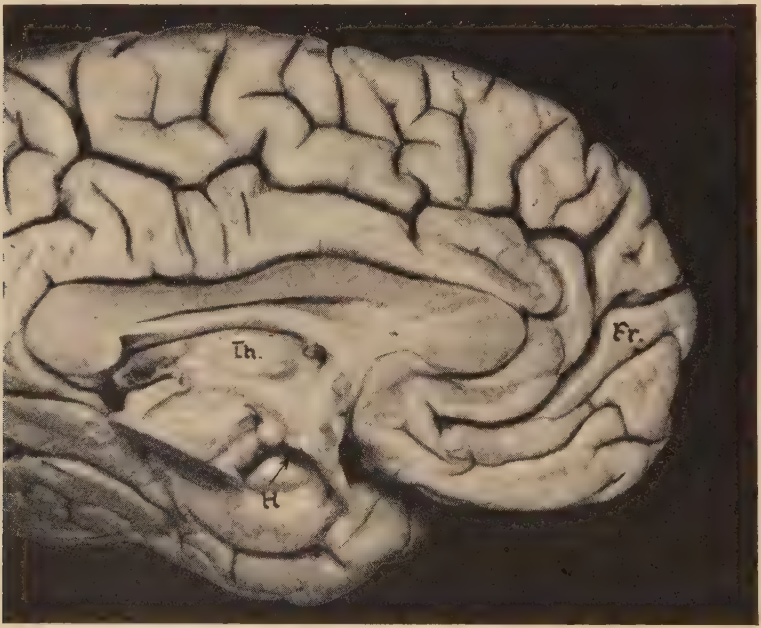

FIG. 2.—Medial aspect of a left hemisphere demonstrating the relationship of frontal lobe (*Fr.*) to thalamus (*Th.*) and hypothalamus (indicated by arrow from *H.*).

(Le Gros Clark, 1948) that the prefrontal region is in essence the projection area of the hypothalamus. The thalamic projection to the prefrontal region arises in the dorsomedial nucleus; that to the anterior cingular region in the anterior nucleus. If the fibres of these projection systems are cut, retrograde degeneration ensues in these thalamic nuclei, and it is possible to infer from the location of the degeneration which parts of the frontal cortex have been cut off. Fig. 3, in which Brodmann's figures have been inserted in diagrams of the dorsomedial nucleus and the anterior nucleus of the thalamus, shows a rough scheme of the "point to point" projections arising from these nuclei. This diagram is an elaboration of a similar one contained in a previous paper (Meyer, McLardy and Beck, 1948). It is based now on the study of 30 hemispheres, and will be published elsewhere in greater detail. It is provisionally included in this paper in order to demonstrate how a histological investigation of the thalamus can add considerably to the accuracy of estimation of the frontal lobe damage.

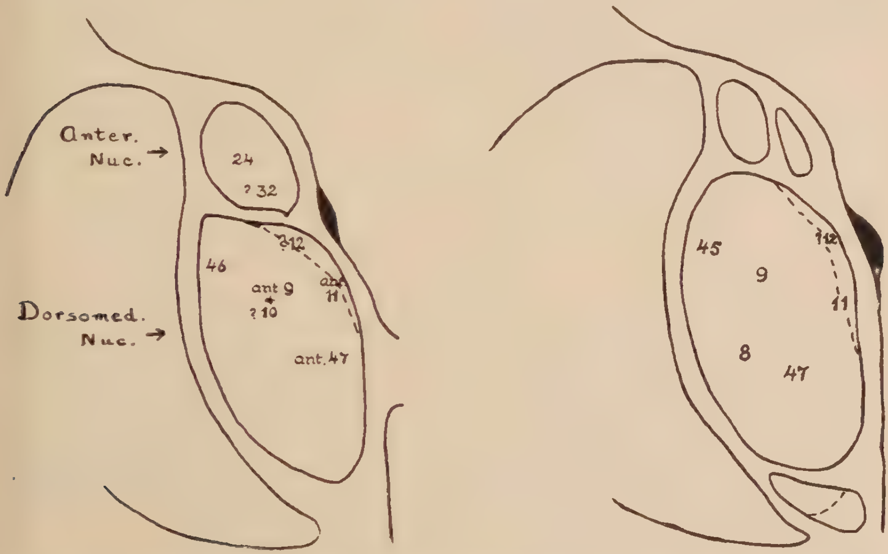

FIG. 3.—The numerals indicate the Brodmann areas of cortex to which the nerve cells in the various parts of the dorso-medial and anterior nuclei of the thalamus project.

The variability of the leucotomy cuts, which was first demonstrated in 1945 (Meyer and Beck), is still an impressive finding in cases operated upon in 1946 and 1947 (Fig. 4). After making due allowance for the unrepresentative nature of our material, for differences of technique used by different neurosurgeons and, in a very few instances, for deliberate intention, it is difficult to escape from the conclusion that, to a large extent, this variability is a consequence of the blind operation based on superficial skull bearings only. The inaccuracy in placing the cut has led to modifications of the surgical technique and, particularly in the U.S.A., to an increasing use of open operations introduced under various names, such as topectomy, gyrectomy and areactomy, all designed to ablate circumscribed cortical areas.

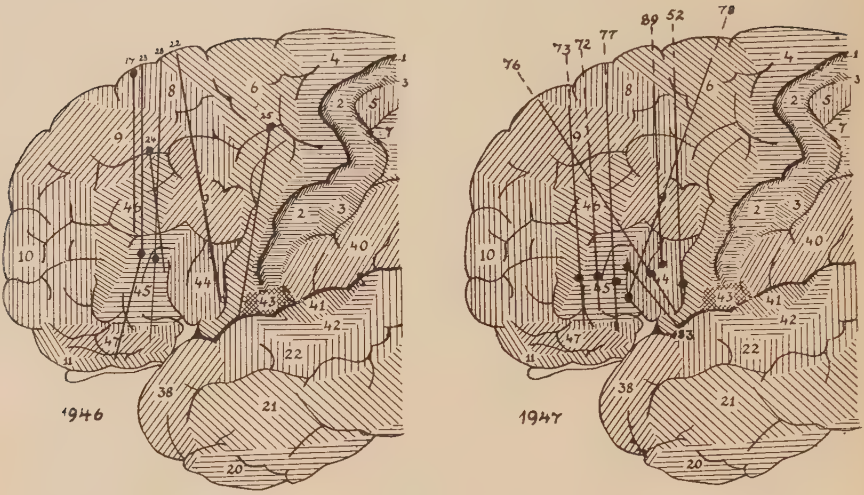

FIG. 4.—Illustrating largely unintentional variability in plane and direction of cuts.

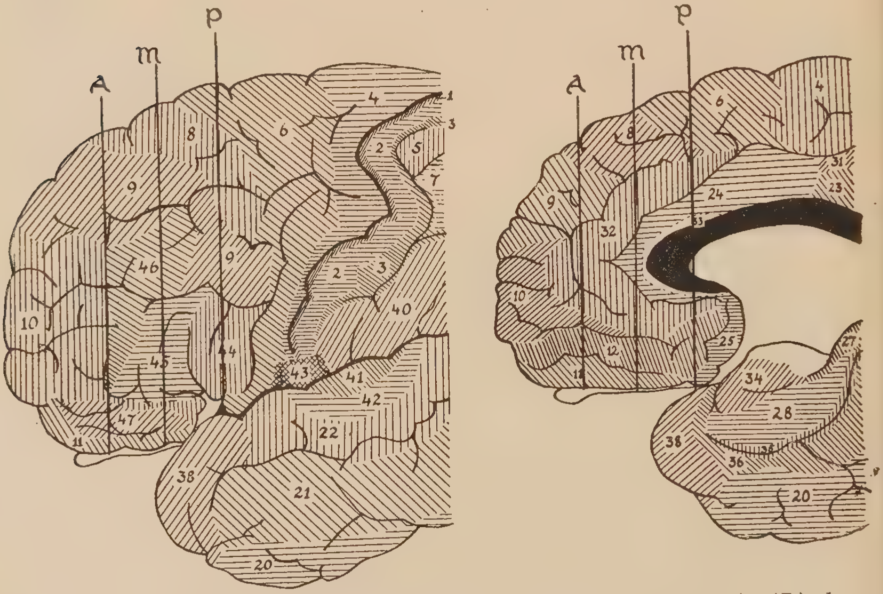

FIG. 5.—Demonstrating the position of Anterior (*A.*), Middle (*M.*) and posterior (*P.*) planes o
the cut in relation to Brodmann's cortical areas.

For purposes of classification our cases have been divided into those wit
cuts in anterior, middle and posterior planes (Fig. 5). In addition to the wid
variation in the antero-posterior position, there are also very considerabl
differences in the extent of the cut in the transverse plane. We have therefor
divided the coronal surface for purposes of analysis into five segments: Dorsal
middle, ventral or orbital, medial or cingulate, and central (Fig. 6). Figs
7, 8 and 9 illustrate such differences in the cut in actual cases.

The variety of the cuts in such leucotomy material gives an opportunity of studying the clinical and anatomical effects of very different frontal lesions indeed. Thus, clinico-pathological correlations can be derived which, in a steadily growing series of cases such as ours, are bound in time to yield results of considerable importance. In an earlier paper the present authors (Meyer and McLardy, 1948) compared the clinical symptomatology in a group of cases in which the surgical lesions were confined to the prefrontal region (i.e. our A and M planes) with another group with bilateral posterior cuts. Tables I and II represent an amplification and modification of the previously published tables. In each of the tables are listed *inter alia* the cause of death (whether intercurrent or otherwise), the survival time and some gross undesirable symptoms, such as restlessness, vasomotor and trophic lesions, persisting incontinence of urine, nutritional deficiency and respiratory disturbance. It is easily seen how few of these undesirable symptoms occur in cases with strictly prefrontal cuts, as compared with those with bilateral posterior cuts. Moreover, the survival time of the patients with posterior cuts is on the average less than half of that of those with prefrontal cuts. Again, most of the patients with posterior cuts die from delayed effects of the operation rather than from intercurrent disease, which is the usual cause of death in the prefrontal group. There is probably a multiplicity of reasons why patients with cuts in the posterior plane should do badly. It will be remembered for instance that such cuts may involve the posterior orbital region, the cingular region and the premotor area—all regions known to be concerned with the control of autonomic function. In addition, the anterior portion of the corpus striatum is liable to be involved, and it is known from animal experiments (Heath, Freedman and Mettler, 1947) that bilateral operations on the basal ganglia are dangerous to life.

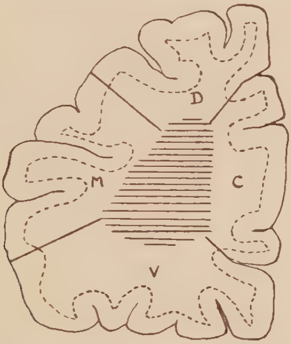

FIG. 6.—*D* = dorsal segment; *M.* = middle segment; *V.* = ventral segment; *C.* = cingulate segment; shaded area = central segment.

The last column of Tables I and II contains data relating to personality change. From the available notes it is not always easy to assess at all accurately the degree and quality of the personality change in these psychotic patients, none of whom was personally known to the authors; hence the considerable number of question marks. Notwithstanding this, there is ample evidence

TABLE I.—*Purely Prefrontal Cuts.*

	Regions involved.												Clinical sequelae.						
Serial number.	Posterior orbital.		Striatum.		Dorsal premotor area.		Ext. caps. and/or insula.		Anterior cingulate.		Anterior orbital.		General restlessness.	Vasomotor and/or trophic.	Persistent incontinence	Miscellaneous.	Survival period.	Intercurrent cause of death.	Post-operative personality change.
	L.	R.	L.	R.	L.	R.	L.	R.	L.	R.	L.	R.							
5	—	—	—	—	—	—	—	—	+	+	+	+	—	—	—	E	1½ yr.	—	+
9	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1¾ ,,	+	+
12	—	—	—	—	—	—	—	—	+	+	+	—	—	—	+	E	2 ,,	+	+
14	—	—	—	—	—	—	—	—	—	—	—	+	—	—	—	—	8 mth.	—	?
18	—	—	—	—	—	—	—	—	—	—	+	+	—	—	—	—	1¼ yr.	+	++
19	—	—	—	—	—	—	—	—	—	—	+	+	—	—	—	—	6 mth.	+	+
26	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	E	3¾ yr.	+	?
31	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1¼ ,,	+	?
34	—	—	—	—	—	—	—	—	—	—	+	+	—	—	—	—	2 ,,	—	?
35	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1 ,,	—	?
39	—	—	—	—	—	—	—	—	—	+	—	—	—	—	—	—	1 ,,	+	+
44	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	3¾ ,,	+	+
46	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	9 mth.	+	?
62	—	—	—	—	—	—	—	—	—	—	+	+	—	—	—	—	2¼ yr.	+	++
63	—	—	—	—	—	—	—	—	—	—	+	+	—	—	—	—	1¾ ,,	+	+
66	—	—	—	—	—	—	—	—	—	—	+	+	—	—	—	R	9 mth.	+	?
67	—	—	—	—	—	—	—	—	—	—	+	+	—	—	—	—	2 yr.	+	++
74	—	—	—	—	—	—	—	—	—	—	+	+	—	—	—	N	3½ ,,	+	+
75	—	—	—	—	—	—	—	—	—	+	+	—	—	—	—	E	3 ,,	+	++
80	—	—	—	—	—	—	—	—	—	—	—	+	—	—	—	—	1¼ ,,	+	+
85	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1¼ ,,	+	?
90	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	E	4¾ ,,	+	?
													Total 8 items.				Average 2 yr.		Total 17+

E = Epilepsy; R = respiratory inhibition; N = nutritional deficiency.

TABLE II.—*Bilateral Posterior Cuts.*

Serial number.	Regions involved.												Clinical sequelae.				Survival period.	Intercurrent cause of death.	Post-operative personality change.
	Posterior orbital.		Striatum.		Dorsal premotor area.		Ext. caps. and/or insula.		Anterior cingulate.		Anterior orbital.		General restlessness.	Vasomotor and or trophic.	Persistent incontinence.	Miscellaneous.			
	L.	R.	L.	R.	L.	R.	L.	R.	L.	R.	L.	R.							
3	+	+	+	+	—	—	—	—	—	—	—	—	—	—	+	N/U	2 mth.	—	+
11	+	+	+	+	—	—	—	—	—	—	—	—	—	—	+	—	5 ,,	—	+
16	+	+	+	+	—	—	—	—	—	—	—	—	—	—	—	—	7 wk.	—	[illegible]
29	+	+	+	+	—	—	—	—	—	—	—	—	—	—	—	H	9 dy.	—	[illegible]
32	+	+	+	+	+	+	+	+	—	—	—	—	—	—	—	N	7 wk.	—	[illegible]
52	+	+	+	+	+	+	+	—	—	—	—	—	+	—	—	—	20 dy.	—	[illegible]
56	+	+	+	+	+	+	+	+	+	+	—	—	—	+	+	—	9 mth.	—	[illegible]
68	+	+	+	+	—	—	—	—	—	—	—	—	—	—	—	U	21 dy.	—	[illegible]
10	+	+	—	—	—	—	—	—	—	—	—	—	—	+	—	N	3 yr.		[illegible]
33	+	+	+	—	—	—	—	—	—	—	—	—	+	+	+	—	10 wk.	—	[illegible]
38	+	+	—	—	—	—	—	—	—	—	+	+	+	—	+	—	1½ yr.	—	[illegible]
41	+	+	—	—	—	—	—	—	—	—	—	—	—	—	—	H	6 dy.	—	[illegible]
49	+	+	+	—	—	—	—	—	+	—	—	+	+	—	—	H	24 ,,	—	[illegible]
59	+	+	—	—	—	—	—	—	+	+	—	—	—	—	—	R	4 hr.	—	[illegible]
65	+	+	—	—	+	+	+	+	—	—	—	—	—	—	—	(R)	3 yr.	+	[illegible]
69	+	+	—	—	—	—	—	—	—	—	—	—	+	—	—	—	2 ,,	+	[illegible]
4	—	—	+	+	+	+	+	+	+	+	—	—	+	+	+	U/N	4 mth.	—	+
20	—	—	+	+	—	—	—	—	+	—	—	—	—	+	+	—	2¼ yr.	—	[illegible]
22	+	—	+	+	+	+	+	+	—	+	—	—	—	+	—	—	9 wk.	—	+
27	+	—	+	+	—	—	+	+	+	—	—	—	—	—	—	—	3¾ yr.	+	?
58	—	—	+	+	—	—	+	—	—	—	—	—	+	—	—	U	7 dy.	—	[illegible]
87	+	—	+	+	—	—	—	—	—	—	—	—	—	—	—	—	1½ yr.	+	?
89	—	—	+	+	—	—	+	+	—	—	—	—	—	+	—	—	3½ mth.	—	+
88	—	—	—	—	+	+	—	—	+	—	—	+	—	+	+	—	8 wk.	—	?
													Total 36 items.				Average 10 mth.		Total 23+

N = Nutritional deficiency; U = uraemia; H = hyperthermia; R = respiratory inhibition.

that personality change, of both the euphoric and the apathetic type, does occur in cases with prefrontal lesions only. Recently Hebb (1945) has submitted the evidence for the existence of a frontal lobe deficit syndrome to severe criticism. This evidence is mainly based upon experience with tumours, head injuries, certain presenile degenerations and frontal lobe extirpations in man and animals. According to Hebb, in none of these conditions can the possibilities be excluded that either the lesions themselves extended beyond the frontal association area, or that the effects were caused by the irritation of actively growing tumour or progressive atrophy or haemorrhagic cysts and scars which causes the behavioural change rather than the loss of normal frontal tissue. Hebb extends his criticism also to leucotomy, maintaining that if personality change appears after leucotomy, it is due more to pathological complications than to the actual severance of the connections of the frontal lobes. It cannot be denied that in leucotomy cases with short survival this point is of considerable importance. For instance, the group with posterior cuts collected in Table II contains a considerable number of cases with short survival, such as represented in Fig. 8, where this may well be one explanation for the severity of the personality change. On the other hand, the example illustrated in Fig. 9 demonstrates the usual appearance in cases with longer survival, the surgical lesion being relatively limited and macroscopically (and also histologically) inactive. It is difficult to believe that such pathological lesions cause much irritation over wide distances.

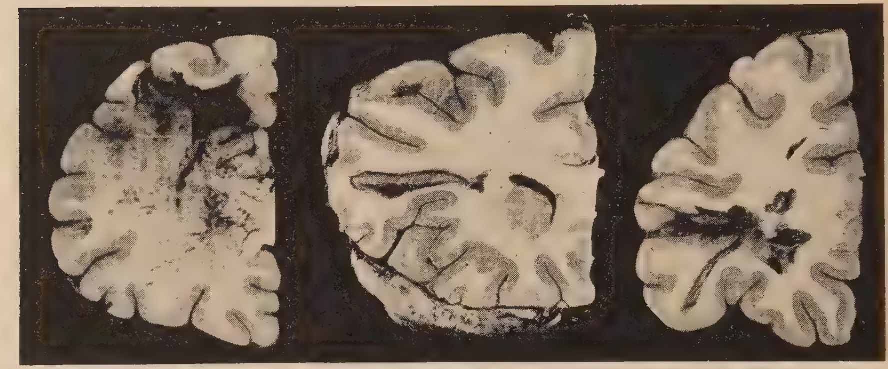

Fig. 7.—Different cases demonstrating cuts predominantly in (*a*) the dorsal, (*b*) the middle and (*c*) the ventral segment.

In view of Hebb's criticisms cases with survival of less than five months have been excluded in Tables III and IV, in which the remainder have been graded roughly according to severity of personality change indicated in terms of plus or minus. For each case there has been plotted the dimensions of the surgical cuts as defined by their mean plane in the antero-posterior direction and the segments involved in the transverse direction. All cases in Table III showed definite personality change, whilst in the cases collected in Table IV down to the dividing line the personality change was either questionable or

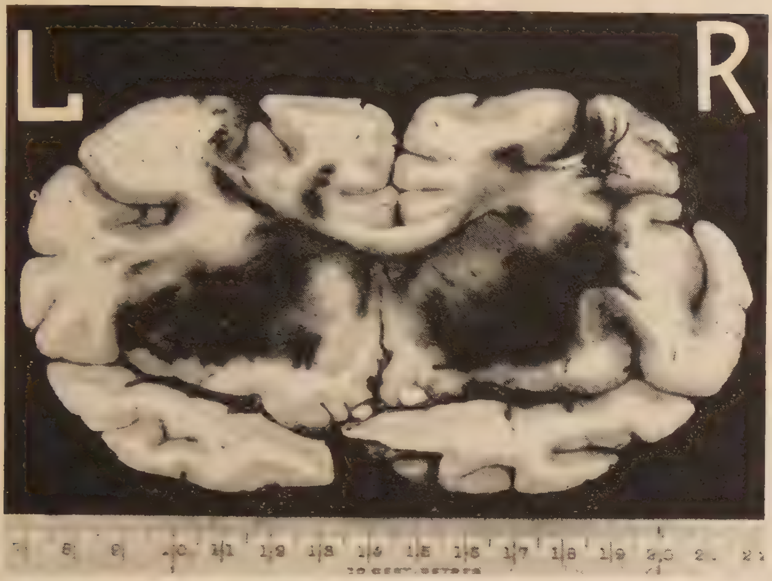

FIG. 8.—Fresh bilateral posterior cuts with haemorrhagic lesions involving the basal ganglia.

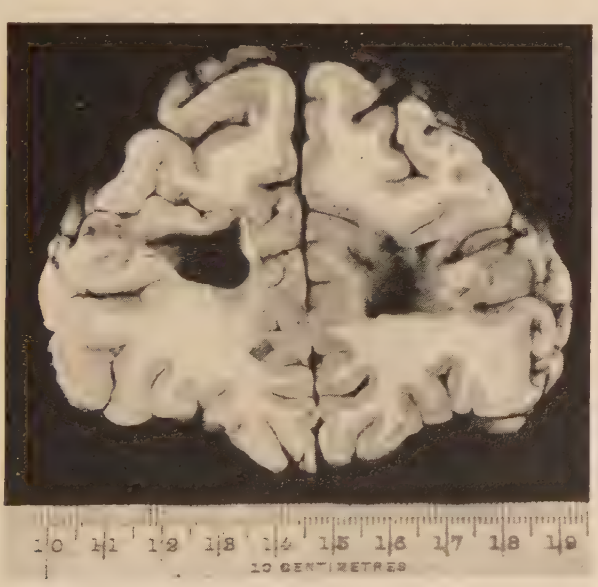

FIG. 9.—Old circumscribed bilateral leucotomy lesions in a fairly anterior plane and practically confined to the central white matter.

negative. There is a striking difference in the number of segments involved between the cases with positive personality change on the one hand and those with negative or questionable change on the other. The average in the former is 7·2 segments in the more severe group and 5·5 in the less severe. In the latter it is 3·4. The average plane of the cuts is not appreciably different in the two groups. In view especially of the unevenness of the clinical data no close parallelism between degree of personality change and extent of damage in

Table III.—*Correlation of the Severity of Personality Change with the Extent of Prefrontal Damage; Cases with ++ and + Degree of Personality Change.*

Serial number.	Post-operative personality change.	Plane of cut.		Segments involved.										Total segments.	
		L.	R.	Dorsal. L.	Dorsal. R.	Middle. L.	Middle. R.	Ventral. L.	Ventral. R.	Central. L.	Central. R.	Cingulate. L.	Cingulate. R.		
10	+ +	M	M	−	−	+	+	+	+	+	+	−	−	6	Average 7·2 segments. M plane.
18	+ +	M	A/M	−	+	+	+	+	+	+	+	+	+	9	
57	+ +	M	M	+	−	+	+	+	+	+	+	+	−	8	
62	+ +	A	A	−	+	+	+	+	+	+	+	−	−	7	
65	+ +	P	P	+	+	+	+	+	+	+	+	−	−	8	
67	+ +	A/M	A/M	−	+	+	+	+	+	+	+	−	−	7	
69	+ +	M	M	+	−	+	+	+	+	+	+	−	−	7	
71	+ +	M	P	−	+	+	+	+	+	+	+	+	−	8	
75	+ +	A	A/M	+	−	+	+	+	−	+	−	−	+	6	
81	+ +	P	M/P	+	−	+	+	−	+	+	+	−	−	6	
86	+ +	A/M	A/M	+	+	+	+	+	−	+	+	−	−	7	
9	+	M	M/P	+	−	+	+	−	−	+	−	−	−	4	Average 5·5 segments. Plane sl. posterior to M.
19	+	M	M	−	−	+	+	+	+	+	+	−	−	6	
20	+	A/M	A/M	−	+	+	+	−	−	+	−	+	−	5	
38	+	P	M	−	−	+	−	+	+	−	−	−	−	3	
39	+	A/M	A/M	+	+	−	−	−	−	+	+	−	+	5	
47	+	M/P	P	−	−	+	+	−	−	−	−	−	−	2	
60	+	M	M	+	+	+	+	+	+	+	+	+	+	10	
61	+	M	M	+	+	+	+	+	+	+	+	−	−	8	
78	+	P	M/P	+	−	+	+	−	−	+	+	−	−	5	
80	+	M	M	+	+	+	+	−	+	+	+	−	−	7	

Table IV.—*Correlation of the Severity of Personality Change with the Extent of Prefrontal Damage; Cases with No and ? Personality Change (above) and Seven Paradoxical Cases (below).*

Serial number.	Post-operative personality change.	Plane of cut.		Segments involved.										Total segments.	
		L.	R.	Dorsal. L.	Dorsal. R.	Middle. L.	Middle. R.	Ventral. L.	Ventral. R.	Central. L.	Central. R.	Cingulate. L.	Cingulate. R.		
8	?	P	P	−	−	−	−	−	−	−	−	−	−	0	Average 3·4 segments. Plane halfway between M and M/P.
14	?	M	M/P	−	−	+	+	−	+	−	−	−	−	3	
21	?	M	M	−	−	+	+	−	−	−	−	−	−	2	
26	?	P	P	−	−	+	+	−	−	−	−	−	−	2	
27	?	P	P	+	+	+	+	+	−	+	−	+	−	7	
31	—	P	P	−	−	+	+	−	−	+	+	−	−	4	
35	—	M	M	−	−	+	+	−	−	−	−	−	−	2	
36	?	M/P	P	−	−	+	+	−	−	−	−	−	−	2	
37	?	M	P	−	+	+	+	−	+	−	+	−	+	6	
46	?	M	M	−	+	+	+	−	−	+	−	−	−	4	
66	?	M	M	+	+	+	+	+	+	+	+	−	−	8	
85	?	M	A	−	−	+	+	−	−	−	−	−	−	2	
87	?	M	M	−	−	+	+	+	−	−	−	−	−	3	
90	—	M	M	−	−	−	+	−	−	+	+	−	−	3	
5	?	A	A	+	+	+	+	+	+	+	+	+	+	10	Average 8·3 segments. Plane halfway between A and A/M.
12	?	A	A	+	+	+	+	+	−	+	+	+	+	9	
44	?	A	A	+	+	+	+	−	−	+	+	−	+	7	
74	?	A	A/M	−	−	+	+	+	+	+	+	−	−	6	
63	?	A/M	M	+	+	+	+	+	+	+	+	−	−	8	
64	?	A/M	M	+	−	+	+	+	+	+	+	+	−	8	
94	?	M/P	M	+	+	+	+	+	+	+	+	+	+	10	

TABLE V.—*Personality Change Correlated with Improvement and Extent of Prefrontal Damage in Different Clinical Types of Cases.*

	Average age at onset (yrs.).	Average pre-operative duration (yrs)..	Average plane of cuts.	Average total number of segments involved (out of possible 10).	Percent. bilateral dorsal segment.	Percent. bilateral middle segment.	Percent. bilateral ventral segment.	Percent. bilateral central segment	Percent. bilateral cingulate segment.	Average personality change.
1. *Predominantly affective conditions.*										
A. *Improved* (11 cases)	45	5½+	A/M–M	6·7	36%	91%	55%	91%	18%	1·5+
B. *Unimproved* (4 cases)	52½	2½+	M	2·8	0%	100%	0%	0%	0%	0·3+
2. *Mixed, mainly paranoid, psychoses.*										
A. *Improved* (6 cases)	43	6	M	5·7	17%	83%	33%	50%	0%	0·8+
B. *Unimproved* (6 cases)	49	6	M	4·2	17%	83%	33%	17%	0%	0·5+
3. *Schizophrenias.*										
A. *Improved* (5 cases) (1 chronic, deteriorated)	—23½	7+	M	8·8	80%	100%	100%	100%	40%	1·2+
B. *Unimproved* (8 cases) (All chronic, 6 deteriorated)	—28	15+	M	5·8	25%	100%	38%	75%	25%	0·8+

individual cases can be expected. At the bottom of Table IV seven cases have been collected which show the apparent paradox of a doubtful personality change with a high number of segments involved. However, in four of these cases the plane of the cut was very anterior, while in the remainder the pre- and post-operative symptomatology of the psychosis was such as to preclude any accurate estimate of the personality change. It is therefore fair that these seven should not be included in the general tables.

Closer analysis of the individual segments shows only the middle segment equally involved in each group. This is not surprising, as the leucotome usually enters the brain in this sector. All the other segments show an increased involvement between the group with negative and the group with positive personality change, but interestingly this is much more marked in the central and ventral segments than in the dorsal and cingulate segments. For the central and ventral segments this parallelism is apparent also between the group with "+" and the group with "++" personality change.

The central segment collects most fibres converging from the prefrontal cortex to form the anterior thalamic radiation. Its prominence in this analysis is, therefore, considering the role which the thalamic connections are believed to play in the rationale of personality change, not surprising, and could be expressed as based upon a quantitative principle. Since, however, the more anterior the plane of the cut the progressively higher a proportion of fibres of the central segment connect with cortex near the pole—i.e. with areas 10, 46 and anterior 9, 11, 12 and 47 in the commonest cut (through area 45) in this series—it follows that these rostral areas are also concerned in the causation of personality change. This is worth noting in view of recent reports (Heath and Pool, 1948 ; Freeman 1948) which deny an appreciable degree of personality change after ablation or isolation of these rostral areas. The explanation for this discrepancy may be, firstly, that involvement of rostral parts alone causes an amount of personality change of no appreciable practical importance or, secondly, that the cortical ablation and transorbital leucotomy are confined largely to dorsal parts, whereas from our analysis the orbital aspect may have greater importance for personality change than the dorsal aspect.

The history of the frontal lobe syndrome shows that damage to the orbital region has for long been regarded as a particularly frequent cause of personality change, especially of the euphoric type associated with "Witzelsucht" (Welt, 1887 ; Schuster, 1902 ; Berger, 1923 ; Kleist, 1934, 1937 ; Spatz, 1937 ; Rylander, 1939 ; Reitman, 1946 ; and others). Kleist and, more recently, Freeman and Watts (1948), and Dax, Reitman and Radley-Smith (1948), have, in addition, associated damage to dorsal parts of the prefrontal region with the akinetic type of personality change. Our analysis so far supports neither of these contentions in their exclusiveness of location and of type of change. Several cases with the euphoric type of personality change had bilateral ventral damage, but others with typical fatuous euphoria had cuts which excluded these regions. Conversely, although several cases with the apathetic (akinetic) type of personality change had bilateral dorsal cuts, many others with such a personality change had no involvement whatever of the dorsal segments. In other words, as in our earlier reports (Meyer and McLardy, 1947 ; Meyer, McLardy and Beck, 1948), we still fail to confirm the existence of atomistic localization of mental faculties within the frontal lobe suggested by Kleist (1934, 1937), even in its simplified form as expressed by Freeman and Watts (1948) and Dax, Reitman and Radley-Smith (1948).

An additional point in this connection which can be deduced from our material is that any importance of the orbital region in the causation of personality change is certainly not confined to its posterior agranular part (containing area 13), which is particularly concerned with autonomic function.

The absence of frequent involvement of the anterior cingulate region in Table III, especially the " ++ " group, is of considerable interest. It does not bear out the views of Ward (1948), who suspected area 24 to be concerned with the mechanism of fear, and therefore recommended its physiological investigation in psychiatric patients. Recent American experience with focal ablation of the cingulate gyrus (Freeman—personal communication) apparently likewise does not support Ward's view. It should be emphasized that detailed analysis of our material shows these remarks to apply to area 24 only and not to area 32 (part of the so-called cingular belt), which rather behaves, in its correlation trends, like the rest of the prefrontal cortex.

There has been much recent controversy about the fibre systems involved in the mechanism of personality change. Freeman and Watts now (1947) lay main emphasis on the thalamo-prefrontal connections, but other workers (Mettler, 1947; Ritchie Russell, 1948; Reitman, 1946) take a less exclusive view. Preliminary reports on thalamotomy, recently introduced by Spiegel and his associates (1947), indicate that bilateral lesions in the dorsomedial nucleus have a marked influence upon personality and improvement, a result which would favour the view that the mechanism of the personality change depends very largely upon the thalamo-prefrontal projection. Cases in our material in which the cuts were behind the frontal lobes confirm this observation. For instance, Fig. 10 demonstrates a case in which the thalamo-prefrontal projection was severed bilaterally in the ventral part of the anterior limb of the internal capsule, and led to a very considerable retrograde degeneration in almost all parts of both dorsomedial nuclei, accompanied by considerable personality change and improvement of the patient's agitated depression. This supplies another explanation of why posterior cuts sometimes cause very severe personality change, the whole of the thalamo-prefrontal projection being easily severed at this level by a circumscribed cut.

The problem of improvement will not be touched upon at length in this paper, which does not deal with therapeutic aspects. The anatomical correlates of improvement will be the subject of a separate paper by the present writers. Since, however, improvement has recently been linked by Frankl and Mayer-Gross (1947) with the personality change, it is relevant to note that the existence of some such association is borne out in our analysis. In Table V the cases with over five months' survival are presented under the three headings of predominantly affective conditions, mixed mainly paranoid psychoses, and schizophrenias, each of these groups being divided into an improved and an unimproved subgroup. It is easily seen that in each of the groups the improved cases tend to have a distinctly higher average number of segments involved, the emphasis being, as with personality change, on the central and to a lesser degree orbital segments. This tendency is still noticeable if the best improved cases are compared with the less well improved cases. As the last column of the table indicates, this tendency runs roughly parallel with the severity of personality change, thus confirming Frankl and Mayer-Gross's clinical impression.

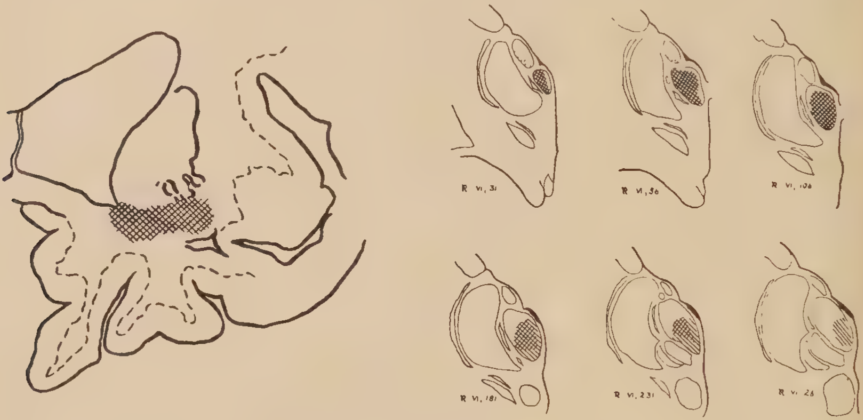

FIG. 10.—Leucotomy lesion (circumscribed posterior cut) in the ventral part of the internal capsule (*a*), severing the great majority of the thalamo-prefrontal projection fibres, as evidenced by (*b*) the almost total retrograde degeneration of the dorso-medial nucleus.

CONCLUSIONS.

A few points stand out with relative clarity. Bilateral lesions confined to the prefrontal region are capable of causing personality change persisting for long after the process of active repair and irritation has become quiescent. This controverts most of the criticisms raised by Hebb against the evidence for a frontal lobe syndrome. The persistent personality change caused by posterior (extra-prefrontal) cuts may be severe, but this is due, our material would indicate, to the cutting of the thalamo-prefrontal projection in its course nearer to the thalamus. These observations also tend to emphasize the importance of the thalamo-prefrontal projection with regard to the anatomical mechanism concerned in the personality change (and probably in improvement), and also to confirm the recent preliminary findings after thalamotomy.

Cases with posterior cuts almost consistently manifest undesirable symptoms of an autonomic or other nature. Some of these appear to have a definite relation to the posterior orbital, cingular and premotor regions, all of which are known to be concerned with autonomic functions.

No confirmation could be obtained of the more detailed and extravagant claims as to localization of mental faculties within the frontal lobe, such as the well-known scheme of Kleist (1934, 1937) suggests. Whatever tendency there may be for any degree of localization is, so far, overshadowed by a quantitative relationship between the degree of personality change and the amount of prefrontal cortex cut off. As personality change and improvement seem to be positively correlated, this quantitative principle would appear to apply also, to some extent at least, to the mechanism of improvement. The anterior cingular region (area 24) appears to play little part in determining personality change.

All these results should be regarded as tentative and liable to considerable modifications in the light of greater numbers of cases and of improved clinical observations. Their publication at the present juncture seems desirable, however, in order to emphasize the importance and potentialities of this type of clinico-anatomical analysis, and thus to stimulate the greatest possible use of this unique human material.

REFERENCES.

BECK, E., *A Cytoarchitectural Investigation into the Boundaries of Areas* 13 *and* 14 *in Man.* In press.
BERGER, H. (1923), *Arch. f. Psychiat.*, **69**, 1.
CLARK, W. E. LE GROS (1948), *Lancet*, **1**, 353.
DAX, E. C., REITMAN, F., and RADLEY SMITH, E. J. (1948), *Digest Neurol. Psychiat.*, **16**, 533.
FRANKL, L., and MAYER-GROSS, W. (1947), *Lancet*, **2**, 820.
FREEMAN, W. (1948), *ibid.*, **2**, 371.
Idem, and WATTS, J. W. (1947), *J. Comp. Neurol.*, **86**, 65.
Idem (1948) *Digest Neurol. Psychiat.*, **16**, 62.
HEATH, R. G., FREEDMAN, D. A., and METTLER, F. A. (1947), *Fed. Proc.*, **6**, 126.
HEATH, R. G., and POOL, J. L. (1948), *J. Nerv. Ment. Dis.*, **107**, 411.
HEBB, D. O. (1945), *Arch. Neurol. Psychiat., Chicago*, **54**, 10.
KLEIST, K. (1934), *Handbuch der ärztlichen Erfahrungen im Weltkriege.* Leipzig, 4.
Idem (1937), *Zeitschr. ges. Neurol. Psychiat.*, **158**, 159.
METTLER, F. A. (1947), *J. Comp. Neurol.*, **86**, 119.
MEYER, A., and BECK, E. (1945), *J. Ment. Sci.*, **91**, 411.
MEYER, A., and MCLARDY, T. (1947), *Proc. Roy. Soc. Med.*, **90**, 141.
Idem (1948), *J. Ment. Sci.*, **94**, 555.
Idem, and BECK, E. (1948), *Folia Psychiat. Neurol. et Neurochir. Neerland., Congresnummer.*
REITMAN, F. (1946), *Amer. J. Psychiat.*, **103**, 238.
RUSSELL, W. R. (1948), *Lancet*, **1**, 356.
RYLANDER, G. (1939), *Acta Psychiat. Neurol.*, Suppl., 20.
SCHUSTER, P. (1902), *Psychische Störungen bei Hirntumoren.* Stuttgart.
SPATZ, H. (1937), *Zeitschr. ges. Neurol. Psychiat.*, **158**, 208.
SPIEGEL, A. E., WYCIS, H. T., MARKS, M., and LEE, A. J. (1947) *Science*, **106**, 349.
WALKER, A. E. (1940), *J. Comp. Neurol.*, **73**, 59.
WARD, A. A. (1948), *J. Neurophysiol.*, **11**, 13.
WELT, L. (1887), *Deut. Arch. f. klin. Med.*, **42**, 339.

THE EFFECT OF LEUCOTOMY ON CREATIVE ABILITY.

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Treatment by prefrontal leucotomy, though undoubtedly of value, still rests upon an insufficiently scientific basis. Its anatomical and physiological effects are being increasingly discovered, but many of its psychological effects are still unpredictable and obscure. Its effect on intelligence, on immediate memory, and on simple learning ability are now well known, but with these we are not concerned. Rather, we have attempted to assess the effect of leucotomy on " creative ability." By this phrase we shall refer to that ability by which the ideational content of past experience is utilized in a situation to provide concepts and actions not directly evoked by the new situation, but elaborated by the patient's more complex cerebral reactions to the situation. The ability is worthy of examination, since the more intellectual the work the more is it evident. The architect, for instance, needs more creative ability than the bricklayer, the novelist more than the amanuensis, and the Royal Academician more than the house painter.

That this type of activity may be affected by leucotomy has been suggested by the results of frontal lobectomy. In the monkey, for instance, Ferrier (1) noticed more than 50 years ago that after the frontal poles had been removed " a very decided alteration in the animal's character and behaviour had taken place. Instead of, as before, being actively interested in their surroundings and curiously prying into all that came within the field of their observations, they remained apathetic or dull, or dozed off to sleep, responding only to the sensations or impressions of the moment." In human patients with lesions of the frontal lobes, few investigators have made a study of the creative ability of the patients, and the few reports are conflicting. Rylander (2) and Goldstein (3) state that the processes of higher intellectual productivity are less effective in such patients ; but the evidence presented on creative ability is meagre. In view of the paucity of facts, we considered it desirable that an investigation should be made into the effect of prefrontal leucotomy on this particular activity.

Investigations already carried out by Hutton and Bassett (4) had suggested that a deficiency in creative ability was shown by leucotomized patients. The tests used for these investigations had been the Rorschach, the Thematic Apperception, the Raven Projection, the Story Telling and the Line Drawing tests, but while these results were suggestive they were not conclusive, and it was then decided to develop a test which should be more specialized for this purpose. Such a test must satisfy the following criteria:

(*a*) It must correlate highly with "creative ability."
(*b*) It must be independent of learning, memory and educational status.
(*c*) It must be objective in its method of scoring.
(*d*) It must yield a permanent record suitable for subsequent examination.
(*e*) It must be applicable to all types of patient.

The factors underlying "creative ability" are probably extensive and hardly to be treated adequately by any single method of approach. We are well aware that the proposed test is limited in its scope and that some aspects of creative ability, perhaps even the most important, may elude it. Nevertheless, the results of the test may not be devoid of interest, particularly since it provides some objective facts to supplement the present meagre knowledge.

After preliminary trials a test was devised which depended essentially on the patient's ability to add to a painting imaginative details which were neither present in the example provided, nor suggested by the experimenter. The patient is first given a simple coloured painting which he is asked to copy as exactly as possible, not making any variation. This completed, he is asked to paint the picture again, but now to paint it as he would like to see it; he is invited, in other words, to add elements neither visible in the example nor described by the experimenter. The difference between the second picture and the first gives a measure of the patient's creative ability. Being a difference, the score is essentially independent of his experience in painting, his innate skill, and his mood of the moment, for all these factors would tend to affect both paintings equally. The paintings are scored from several points of view: the various scores provide measures not only of the patient's creative ability, but also of certain complicating factors. The test has the advantage that by providing means for the measurement of these complicating factors, it enables them to be eliminated.

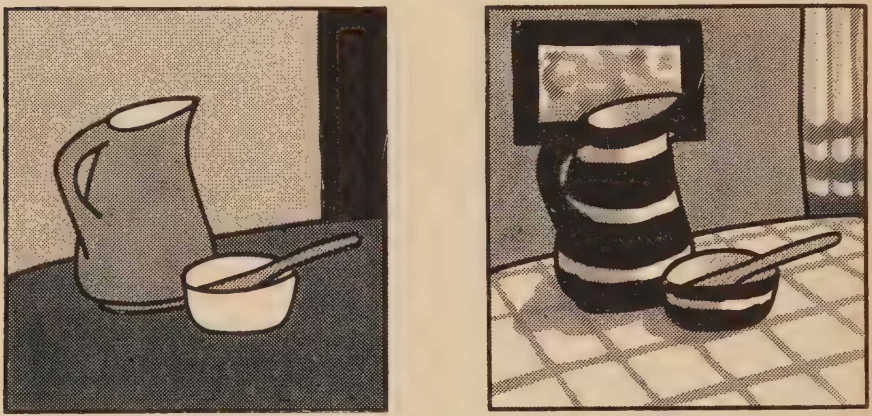
The "H & B" test was applied to 25 patients, all of whom had undergone prefrontal leucotomy. As a control group the ideal would, of course, have been the same 25 patients before their operation, but this arrangement was not practicable. For control groups we have therefore used 25 normal persons and also 25 psychotic patients who matched as closely as possible the group from which the leucotomized patients were drawn.

The H & B test will next be described in definitive form.

The H & B Test.

The patient is provided with paint brushes, palette, water, and pots of poster paint in nine colours: brilliant orange, golden chrome, oxford ochre, ultramarine, cobalt violet tint, deep green lake, prussian blue, chinese white, and ivory black. In the first part of the test he is shown a simple coloured painting—the "example."

The example is 3½ in. square, and shows a jug, bowl, spoon and curtain, coloured orange, cream, grey and black respectively, on a background of purple and on a base of pale green. Each colour is even over its whole area, so that no modulation occurs. A single black line separates the colours. He is then provided with a line drawing which is devoid of colour, but which matches the example in bearing the black outlines of the jug, bowl, spoon and curtain. He is asked to paint into the spaces between the lines so as to copy the example as exactly as possible. To copy the example exactly requires some blending of colours, but the skill required is small : experience with the test confirms that the blending causes little difficulty. The instruction given to the subject is : " Please copy this as exactly as you can. There is no time limit." No further instructions may be given ; any query must be answered only by a repetition of the original instruction.



Typical pair of paintings produced by a subject of high creative ability. That on the left closely resembles the example (which is not shown, but is similar) ; that on the right shows abundant imaginative additions.

When he has finished his copy both it and the example are removed, and the second part of the test is commenced. He is provided with another line drawing identical with the one he has just used, and he is given the instruction : " Paint this as you would like to see it." When this painting has been completed to his own satisfaction the test is complete.

The next step is to convert this pictorial material into numerical scores which measure those five psychological characteristics in which we are interested and on which the data give relevant information. The following 23 criteria are applied (A to I on the first, and J to W on the second painting) ; each is allotted 1 mark if the answer is " yes," and 0 mark if the answer is " no " :

A–E. Does the colour of (A) the jug, (B) bowl, (C) spoon, (D) background, (E) base, match that of the example ?

F. Do the shapes of the objects approximate to those of the example ?

G. Has any paper been left unpainted ?

H. Has any colour been changed from that of the example ?

I. Has the space in the jug handle been either omitted or painted wrongly in relation to background ?

J. Are any new colours used ?

K. Has the colour of the jug been changed to blue ?
L. Has any addition been made (excluding those of M N O below) ?
M. Has a design been applied to the background or base ?
N. Has a design been applied to any of the objects other than background or base ?
O. Has shading of any kind been applied ?
P. Is there any differentiation between the inner and the outer surfaces of either jug or bowl ?
Q. Has either the handle or the base of the jug been painted a colour different from the body ?
R. Has purple been used as a flat wash anywhere ?
S. Has black been used as a flat wash anywhere ?
T. Have any of the objects been painted out ?
U. Are jug, bowl, spoon, curtain, all clearly shown ?
V. Has either base or background been left unpainted ?
W. Has the space in the jug handle been either omitted or painted wrongly in relation to the remainder of the background ?

The scoring is simple and direct ; each question can be answered by "yes" or "no." These answers are allotted the arbitrary scores of 1 and 0 respectively. Whether the scores are to be taken positively or negatively, and whether the different criteria should be given scores of different magnitudes, are questions which need not be considered at this stage, for full consideration will be given later.

In order to give objectivity to the question "Does the colour match ?" and in order to allow a reasonable deviation to the less skilful painters, for each tint in the example a card was prepared bearing two similar tints which showed the limits within which a tint must lie if it was to be judged as "matching."

In order to test the objectivities of the 23 criteria, two experimenters independently scored the final 150 paintings by these criteria. Of the 3,450 (i.e. 2×23×75) scores allotted, 1,540 pairs agreed and 185 pairs disagreed ; so the agreement was 89 per cent. Since this type of test measures concepts of some complexity, the degree of objectivity reached may be considered satisfactory.

The criteria are not all independent, nor are they intended to be. Criteria A to I, for instance, are linked by the common factor of "accuracy," for they all depend on the precision with which the example has been copied. The 23 criteria are therefore compounded into five basic Sets, each almost homogeneous in its psychological content. These five Sets will now be described.

Set 1 contains the criteria A to I. The characteristic measured is the ability to copy the example with precision. The score for the Set is the sum of the marks for A, B, C, D, E and F, minus the sum of the marks for G, H and I. (The last three marks are given signs opposite to those of the remainder because the last three questions are more conveniently stated in inverted form ; thus a "Yes" in A implies a good colour match and more "accuracy," while a "Yes" in G implies an unpainted part and less "accuracy".) For convenience in reference we have given this Set the arbitrary label of "accuracy."

Set 2 contains the criteria J, K, L, M, N, O, P and U. The score for the Set is the sum of the marks for these criteria. The characteristic measured is the ability to vary from the given example by the introduction of some new element. The measurement of this ability is, of course, our primary aim.

New elements can be introduced either by the addition of objects, the addition of design, the addition of shading, or the alteration of the colour scheme. If new elements are added, their form will, of course, depend on the characteristics of the patient's personality. With these characteristics, however, we are not primarily concerned, since our interest is focussed on the simple ability to add elements which were neither visible in the example nor suggested by the experimenter. We have given this Set the arbitrary label of " creative ability."

Set 3 contains the single criterion T. The characteristic measured is the painting out of objects. The score for this Set is the mark given to T. We have given this Set the arbitrary label of " annihilation."

Set 4 contains the criteria R and S. The characteristic measured is the occurrence of either black or purple in the second painting. The score for this Set is the sum of the marks given to R and S. We have given this Set the arbitrary label of " persistence."

Set 5 contains the criteria Q, V and W. The characteristic measured is the inability to treat the picture as an integrated whole. The score for the Set is the sum of the three marks. We have given this Set the arbitrary label of " omission."

The five Sets thus reduce the performance of each patient to a vector of five numbers ; thus patient No. 1 scored [8, 8, 0, 0, 0], while No. 2 scored [2, 5, 0, 4, 4].

The test was then applied to the patients and to the controls. These we will now describe.

The Subjects.

Of the 25 leucotomized patients, 18 were living outside and 7 were still in hospital. The intervals between operation and testing ranged from 4 weeks to 7 years ; the average interval was 3 years.

For controls we had two groups : one of 25 normal persons, and one of 25 psychotic and non-leucotomized patients. The latter were selected to resemble as closely as possible the type of patient from which the subjects had been taken for leucotomy. We shall refer to the three clinical types as the " Leucotomized," the " Normal," and the " Psychotic," often using the abbreviations L, N and P.

These 75 persons were subjected to the test. The paintings were scored in the manner defined, and the scores are shown in Table I.

The Results.

The scores will first be analysed to provide the basic facts. Their interpretation will be postponed until the discussion.

The first analysis will ascertain whether the three clinical types (L, N and P) differ significantly in their scores. The Sets will be examined separately ; questions which involve their inter-relations will be discussed in a later paper.

TABLE I.—*Scores Achieved by 75 Subjects in the 5 Sets.*

Clinical type.																	
Normal.						Psychotic.						Leucotomized.					
Subject number.	Set. 1.	2.	3.	4.	5.	Subject number.	Set. 1.	2.	3.	4.	5.	Subject number.	Set. 1.	2.	3.	4.	5.
1	8	8	..	..	..	21	9	7	1	2	..	2	2	5	..	4	4
4	11	11	..	..	..	29	10	5	..	..	..	5	12	4	..	..	4
6	4	4	..	2	..	39	6	5	1	2	2	8	8	2	2	4	..
9	8	9	..	..	..	42	—1	6	..	4	2	11	—4	6	..	2	4
10	6	9	..	2	..	44	4	10	..	3	1	13	6	4	..	..	2
14	7	8	..	..	..	56	0	6	..	4	4	19	11	2	..	2	..
15	9	5	..	..	..	61	—2	3	..	..	..	31	11	6	..	2	..
16	5	7	..	3	..	68	1	7	..	2	2	37	10	4	..	1	..
18	10	5	..	2	..	70	—4	1	..	..	2	40	4	11	..	..	2
23	5	8	..	4	..	71	—1	2	..	2	2	41	2	2	2	2	4
28	10	8	..	..	..	72	6	3	..	2	..	49	1	6	..	..	..
32	8	8	..	..	..	73	3	5	1	4	1	51	4	9	..	2	..
33	8	14	..	..	..	74	7	5	..	2	..	53	0	4	..	4	4
35	7	5	..	..	..	75	—5	0	..	..	3	55	—1	1	2	4	2
38	4	6	..	4	..	76	—4	3	..	2	5	57	11	9	..	..	4
43	10	6	..	1	..	77	0	2	1	..	2	59	5	7	..	2	2
45	10	11	..	..	..	78	3	6	..	..	..	62	5	3	2	2	3
46	10	11	..	..	1	80	1	1	2	..	2	63	4	4	1	..	1
50	6	7	..	..	..	81	6	6	..	4	2	64	11	8	..	..	..
52	11	7	..	..	..	82	5	1	..	..	..	65	2	2	2	..	4
54	8	10	..	..	..	83	—4	2	..	..	5	66	1	5	..	4	..
58	9	11	..	..	..	84	5	2	..	2	..	67	5	6	..	4	..
60	11	8	..	3	..	85	—4	4	..	2	3	79	0	3	..	2	2
7	12	13	..	..	1	89	—5	3	2	..	3	87	2	7	..	..	2
20	7	8	..	..	..	86	5	11	..	2	..	88	0	4	..	4	2
Mean Score	8·2	8·3	0·0	0·84	0·08	Mean score	1·6	4·2	0·32	1·56	1·64	Mean score	4·5	5·0	0·44	1·80	1·84

Set 1.

The mean scores of the three clinical types are:

Leucotomized	4·5
Normals	8·2
Psychotics	1·6

The statistical significance of the differences is shown by the analysis of variance in Table II.

TABLE II.—*Analysis of Variance of the Scores in Set* 1.

Variance.	DF.	Sum square.	Mean square.	Variance ratio.	P.	Significance.
Clinical types	2	534·32	267·16	17·3	<0·001	* *
Residual	72	1111·36	15·4355	..	..	..
Total	74	1645·68	..	..	..	..

We shall use throughout Yates' (5) convenient symbolism, where 0 represents "not significant," * represents "significant at a 5 per cent. level," and * * represents "significant at the 1 per cent. level."

The right hand column of Table II shows that the three clinical types differ in their scores in Set 1 by amounts which are undoubtedly significant statistically.

The comparisons between the pairs of clinical types are made as follows. Since the residual variance is 15.4355, the variance of the mean score will be one twenty-fifth of this, and the standard deviation will be its square root, i.e $\sqrt{15.4355/25}$, which is $\pm$ 0·786. The standard deviation of the difference between two of the means will be $\sqrt{2}$ times this. The difference will be significant if it exceeds twice its standard deviation, i.e. if it exceeds $2\sqrt{2} \times 0{\cdot}786$, which is $\pm$ 2·22. Thus the means of the leucotomized and psychotics differ by 2·9; as this exceeds 2·22, the difference is significant. If we indicate this difference by the obvious symbol L/P, we find the significances of the differences to be:

L/P : **
N/L : **
N/P : **

All three clinical types are therefore significantly different from one another in their scores for "accuracy."

The data of Set 1 show, therefore, that the leucotomized are neither as "accurate" as the normal, nor yet as "inaccurate" as the psychotic. The interpretation of the results is discussed later.

Set 2.

This score measures the feature which we have called "creative ability." It is, of course, the characteristic in which we are primarily interested. The three clinical types have mean scores:

Leucotomized	5·0
Normal	8·3
Psychotic	4·2

The analysis of variance of the scores is given in Table III.

TABLE III.—*Analysis of Variance of the Scores in Set* 2.

Variance.	DF.	Sum square.	Mean square.	Variance ratio.	P.	Significance.
Clinical types	2	232·1868	116·09	16·90	<0·001	**
Residual	72	494·5600	6·869	..	..	..
Total	74	726·7468	..	..	..	..

The statistical significances of the differences between the mean scores are found, by the same method as in Set 1, to be:

L/P : 0
N/L : **
N/P : **

The data show, therefore, that the leucotomized and the psychotic have considerably less "creative ability" than the normal. The interpretation of this result will be discussed later.

Set 3.

This score measures the feature which we have called "annihilation." The three clinical types have mean scores of:

Leucotomized	0·44
Normal	0·00
Psychotic	0·32

The analysis of variance of the scores is shown in Table IV.

TABLE IV.—*Analysis of Variance of the Scores in Set* 3.

Variance.	DF.	Sum square.	Mean square.	Variance ratio.	P.	Significance.
Clinical types	2	2·5866	1·2933	3·638	0·04	*
Residual	72	25·6000	0·3556	..	..	..
Total	74	28·1866	..	..	..	..

As the scores are small integers, varying discontinuously, and as Fisher's z-test is based on the assumption that the variables are distributed continuously and normally, there is some doubt as to whether this test is properly applicable. An alternative test of significance, not using these assumptions, may be made by comparing in the three clinical types how often zero and non-zero scores occur. The frequencies are shown in Table V.

TABLE V.—*Frequencies of Zero and Non-zero Scores in the Three Clinical Types in Set* 3.

		Clinical type.			Total.
		N.	P.	L.	
Score	Zero	25	19	19	63
	Non-zero	0	6	6	12
Total		25	25	25	75

The χ^2-test is appropriate here. χ^2 ||| 7·14, n ||| 2, and P ||| 0·03 ; so the differences between the three clinical types are significant at the 5 per cent. level, in agreement with the previous result.

The statistical significances of the differences between the mean scores are :

L/P : 0
N/L : **
N/P : *

The data shows that the leucotomized score higher for "annihilation" than the normal.

Set 4.

This score measures the feature which we have called "persistence." The three clinical types have mean scores :

Leucotomized	1·80
Normal	0·84
Psychotic	1·56

The analysis of variance of the scores is shown in Table VI.

TABLE VI.—*Analysis of Variance of the Scores in Set 4.*

Variance.	DF.	Sum square.	Mean square.	Variance ratio.	P.	Significance.
Clinical types	2	12·48	6·24	2·782	0·08	0
Residual	72	161·52	2·243	..	..	..
Total	74	174·00	..	..	..	..

For the same reasons as those given in the discussion of Set 3, an alternative test of significance may be applied to the data in Table VII.

TABLE VII.—*Frequencies of Zero and Non-zero Scores in the Three Clinical Types in Set 4.*

		Clinical type.			Total.
		N.	P.	L.	
Score	Zero	17	10	9	36
	Non-zero	8	15	16	39
Total		25	25	25	75

$\chi^2 = 6{\cdot}10$, $n = 2$, and $P = 0{\cdot}04$, which is similar to the value in Table VI. The evidence therefore suggests, without proving, that there is some distinction between the three clinical types in their scores for this character. The statistical significances of the differences between the mean scores are :

L/P : 0
N/L : *
N/P : 0

The data suggests, therefore, that the leucotomized differ from the normal in the character "persistence."

Set 5.

This score measures the feature we have described as "omission." The three clinical types have mean scores :

Leucotomized	1·84
Normal	0·08
Psychotic	1·64

The analysis of variance of the scores is given in Table VIII.

TABLE VIII.—*Analysis of Variance of the Scores in Set* 5.

Variance.	DF.	Sum square.	Mean square.	Variance ratio.	P.	Significance.
Clinical types	2	46·4266	23·2133	13·16	0·001	**
Residual	72	126·96	1·7633	..	..	..
Total	74	173·3866	..	..	..	..

For the same reasons as those given in the discussion of Set 3, an alternative test of significance will be applied to the data in Table IX.

TABLE IX.—*Frequencies of Zero and Non-zero Scores in the Three Clinical Types in Set* 5.

	Clinical type.			Total.
	N.	P.	L.	
Score Zero	23	9	9	41
Score Non-zero	2	16	16	34
Total	25	25	25	75

$\chi^2 = 21{\cdot}1$, $n = 2$, and P is less than 0·001. There is therefore no doubt that the differences between the mean scores are statistically significant. The significances of the individual differences between the mean scores are :

L/P : 0
N/L : **
N/P : **

The data show, therefore, that both psychotic and leucotomized score for "omission" significantly higher than the normal.

DISCUSSION.

We have now measured the performances of the three clinical types in each of the five characteristics, and we have made the primary comparisons between the three clinical types.

But before discussing the interpretations of these comparisons we must first be satisfied that the psychotic are sufficiently well matched with the leucotomized to be valid as controls. With regard to sex distribution, age and clinical diagnosis, the two groups are as follows. In the leucotomized group there were 11 males and 14 females, and in the psychotic group there were 12 males and 13 females. The average age of the leucotomized group was 41 years, the average age of the psychotic group was 54 years. In the leucotomized group there were 10 schizophrenic patients, 6 obsessional patients, and 9 others. In the psychotic group there were 10 schizophrenic patients, 4 manic-depressive patients, and 11 others. It has been shown that in four out of the five characteristics the two groups do not differ significantly. Of the 25 psychotic controls, 4 have since been leucotomized, and 2 more have been recommended for the operation. We may conclude, therefore, that the two groups are reasonably well matched.

The next question to be discussed is whether the test, as a means of detecting changes in creative ability is adequate.

Is the score in Set 2 determined chiefly by " creative ability " and not by some other factors ? The test can measure this ability only partially, but the score in Set 2 seems to be determined chiefly by this ability. Thus the criteria determining the score in Set 2 are J, K, L, M, N, O, P and U. All these criteria measure the patient's ability to add elements which have been elaborated by his more complex cerebral reactions from the ideational contents of his past experiences. The score in Set 2 of the test may, therefore, justly be claimed to be determined by creative ability as defined in this paper and not by some other factor.

The sensitivity of the test must be discussed, since a failure to show a difference between two groups might be due to a coarseness of the measuring device. Our experiment, however, demonstrates that the test is sufficiently sensitive to show significant differences between the normal and the leucotomized in all 5 characteristics, between the normal and the psychotic in 4 out of the 5 characteristics, and between the psychotic and the leucotomized in 1 of the 5 characteristics. There seems, therefore, little reason to doubt that if a major difference existed between the leucotomized and the psychotic in " creative ability " then this difference would also have been detected. The test therefore appears to be sufficiently sensitive.

Since we have now shown that the test is both sufficiently specific and sufficiently sensitive we may turn to the data in their relation to the main subject of the paper.

What is the effect of prefrontal leucotomy on creative ability ? The results of Set 2, stated earlier, showed that the three clinical types had mean scores—

Leucotomized . . .	5·0
Normal	8·3
Psychotic	4·2

The differences N/L (3·3) and N/P (4·1) were significant, while L/P (0·8) was not. What deductions may be drawn ?

It is clear from the results that the presence of a psychosis is itself sufficient to cause a marked decrease in creative ability as measured by our test. The psychotic obtains, on the average, only a half of the score obtained on the average by the normal, and this difference is significant statistically.

This fact must be allowed for when we interpret the score of the leucotomized. The fact that the leucotomized score was significantly lower than the normal might suggest that the operation was responsible for the fall in score. But before operation the patients in the leucotomized group were themselves psychotic, so the effect of the operation will be best shown, not by comparing the leucotomized with the normal, but by the comparison between leucotomized and psychotic. The difference between their mean scores is small (0·8) and statistically insignificant. *The evidence suggests, therefore, that the operation* per se *does not tend to lower the score for creative ability.*

How does this conclusion agree with the work of other investigators? As far as is known, no other systematic work on creative ability has yet been done. Such other evidence as is available will, however, be collected and described briefly.

Freeman, who has had extensive experience of the results of leucotomy, thinks that creative ability, while sometimes impaired temporarily by the operation, is not permanently affected: "The capacity for imagination appears to be reduced to some degree following pre-frontal lobotomy, but by no means in the measure that it does following lobectomy reported by Rylander and others. There is a period following the operation when the imagination is decidedly dulled, although later on it returns to a considerable degree so that constructive intellectual work of high calibre can be performed."(6)

He supports this contention by a detailed description of his Case 34. The patient was a man, aged 54, and a tool designer. As a young man he was described as brilliant, imaginative and sensitive. Prefrontal leucotomy was performed for the relief of severe obsessional neurosis. Later he invented an elliptical wheel-dressing device which was patented twelve months after the operation. Freeman states that the patient finally showed not only good judgment, but initiative and imagination.

Three other cases are also mentioned by Freeman (6) (Nos. 58, 42, 50), in which constructive intellectual work has been performed after leucotomy.

Vencowsky and David (7) have reported the appearance of creative artistry in three cases after the operation, but no details are at present available.

Reitman (8) (9) has described two cases in which a creative spell has occurred after leucotomy; he finds that "the operation gave stimulus to the personality, developing its artistic reactions." "There is little doubt that the creative spell was activated by the operation." While the relevance of his observations to ours is difficult to determine, there remains, nonetheless, his demonstration that creative activity is not rendered impossible by leucotomy.

CONCLUSION.

Though the series studied by us is small, and though the subject of "creative ability" is too large to be explored adequately by one investigation, yet the investigation reported here can claim some advantages over the somewhat scattered observations and impressions which have been published. The test we have used was specially devised to test this function objectively. Evidence internal to the test suggests that it is both sensitive and specific. The results given by it point uniformly to the conclusion that creative ability is not markedly impaired by prefrontal leucotomy. The facts elicited by other workers are not considered to be incompatible with this conclusion.

SUMMARY.

We have investigated the extent to which creative ability is impaired by prefrontal leucotomy, and have devised a test to explore this function objectively. The results are valid only for that aspect of creative ability which is accessible to our test.

Seventy-five subjects were tested in this way—25 leucotomized patients, with 25 each of normal persons and psychotic patients as controls.

The 3,450 scores were analysed. The results are described in detail in the paper.

They show no evidence that creative ability is impaired by prefrontal leucotomy.

REFERENCES.

(1) FERRIER, D. (1886), *The Functions of the Brain.* London.
(2) RYLANDER, G. (1939), *Acta Psychiat. Neurol.*, Suppl. XX.
(3) GOLDSTEIN, K. (1944), *J. Psychol.*, **17**, 187.
(4) HUTTON, E. L., and BASSETT, M. (1948), *J. ment. Sci.*, **94**, 332.
(5) YATES, F. (1937), *Design and Analysis of Factorial Experiments.* Harpenden.
(6) FREEMAN, W., and WATTS, J. W. (1942), *Psychosurgery.* Springfield.
(7) VENCOWSKY, E. and DAVID, V. (1948), Conference on Psychosurgery, Lisbon.
(8) REITMAN, F. (1947), *J. ment. Sci.*, **93**, 55.
(9) *Idem* (1947), *J. Nerv. Ment. Dis.*, **105**, 582.

THE RESULTS OF PREFRONTAL LEUCOTOMY IN 68 PATIENTS NOT DISCHARGED FROM HOSPITAL.*

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The 68 patients surveyed in this paper form a companion group to the equal number who have been discharged from hospital and of whom a follow-up study has been published by Frankl and Mayer-Gross (1947). The patients' condition was studied during the early months of 1947, when they had remained in hospital from 1 to 4 years after operation or had returned after an unsuccessful attempt at discharge. To what extent they have to be considered as failures will be seen in the paper. They are of special interest not only as a contrast to the more successfully treated patients, but also because a closer observation of the course of their illness was possible than with the discharged group. Being under constant clinical observation since the operation, all significant changes in their condition have been recorded and the important problem of relapse, neglected in the large literature on leucotomy, can be discussed on the basis of these observations. Finally, an answer was sought to the question of why these patients should have reacted less favourably to the operation than their fellows.

The material consists of 36 men and 32 women and includes 2 cases of involutional melancholia, 3 cases of epilepsy and 1 example each of manic-depressive psychosis, post-encephalitic parkinsonism and general paresis. The remaining 60 patients suffer from schizophrenia, 27 being of the paranoid type, 18 of the hebephrenic and 15 of the catatonic. The paramount indication in the selection of these cases for operation was the presence of " mental tension." This well-understood clinical concept was adequately defined by Berliner *et al.* (1945) in a previous communication from this hospital.

The age of the patients at operation varied from 22 to 59, with an average of 37 years. The chronicity of illness is shown by an average duration of 8·4 years. The duration of the present attack ranged from 7 months to 20 years, giving an average figure of 7·8 years. The length of time spent in hospital varied from 6 months to 18 years, with a mean figure of 5·8 years. In Table II more detailed information is given regarding the duration of the present attack. In only 5 cases was this period less than 2 years.

In the majority of cases the well-established but less drastic methods of physical treatment had been tried. Of 60 schizophrenic patients 25 had received pharmacological convulsive treatment with single or, more usually, repeated courses of convulsions, and 20 of these were reported as being improved.

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* Adapted from an M.D. thesis accepted by the University of Glasgow.

Of the same group of patients 48 were given electrical convulsive therapy and 36 of them improved. Improvement was reported as amounting to remission in 4 cases, as being considerable in 2, as partial in the remainder, but in all cases it was transient. Generally, repeated courses showed the effect of electroplexy to diminish, although some patients gave a continued response over several years to "maintenance" treatment administered as described by Moore (1943). Of the 60 schizophrenics, 27 received insulin coma treatment, 17 of them with benefit. Here, too, improvement was transient and varied from a good remission to the more common brief partial amelioration. Several patients were given two or more courses. Diminishing effect was not so obvious as with convulsive treatment. Each case treated by Sakel's method also received convulsive therapy. Where insulin was not given the duration of the illness was too long to offer any hope of improvement by this means. Only 5 cases of schizophrenia received no physical treatment, either because of a contraindication in their bodily state or because they had been hospitalized for many years before physical therapies were in common use. Of the 5 schizophrenic patients with a present attack of less than 2 years, 3 had failed to respond to electroplexy and insulin treatment and were deteriorating. One was considered too old for insulin and the other had a history of previous attacks over many years.

The 3 patients with a depressive illness had been given repeated convulsive treatment. The 3 cases of epilepsy had received anticonvulsant drugs for many years and in 2 of them the effect of electrically-induced convulsions had been tried in an attempt to influence the psychic equivalents in which they were aggressive and violent. The post-encephalitic patient was given optimum doses of stramonium for years and in her case pharmacological convulsive treatment had failed to modify her frequent outbursts of violent behaviour. The general paretic had been treated by arsenicals, malaria and inductotherm hyperpyrexia. He retained his grandiose delusions and was tormented by vivid auditory hallucinations.

In this series two different operative techniques were used: 16 patients were operated on by the "horizontal cut" and form part of a group of which a follow-up study has been made by Dr. G. P. Egan (1949). In the remaining 52 the cut was made in the plane of the coronal suture as described by Freeman and Watts. Whichever cut was used the procedure was a standard one. Surgical technique was not modified according to the age of the patient or the duration or severity of the psychosis.

General Results.

The criterion of improvement is the standard of the patient's post-operative behaviour and the grading corresponds to that described by Berliner *et al.* (1945). For the sake of clarity that description may be repeated here.

Six patients are regarded as being "much improved." They can now have parole, do useful work under supervision and enjoy the recreational facilities of the hospital. They are potential discharges and some of them would have left hospital had their home environment been more suitable.

Ten patients have improved. They can now take part in occupational and recreational therapy or do useful work in the hospital, on the farm, or in the gardens. Most of them before operation were serious nursing problems.

Twenty-eight patients have improved slightly. They have lost troublesome features of their illness, such as violent or destructive behaviour, while their psychosis remains basically intact.

Twenty patients are regarded as unchanged, some of them after an early but fleeting improvement. Four patients are classified as "worse." The significance of this result will be considered below.

The following table gives the results according to the diagnosis, with subdivisions in schizophrenia. It shows 4 cases of schizophrenia to be much improved, 10 to have improved, and 25 to be "slightly improved"; 39 schizophrenics have benefited to some extent out of a total of 60 undergoing operation; 17 cases of schizophrenia are unchanged and the 4 "worse" cases also came under this diagnostic heading.

TABLE I.—*Results According to Diagnosis.*

	Par.	Heb.	Cat.	Invol.	M.–D.	Ep.	P.P.	G.P.I.	Total.
M.I.	2	—	2	1	1	—	—	—	6
I.	3	4	3	—	—	—	—	—	10
S.I.	14	5	6	—	—	2	—	1	28
U.	7	7	3	1	—	1	1	—	20
W.	1	2	1	—	—	—	—	—	4
Total	27	18	15	2	1	3	1	1	68

Key to table: M.I., much improved; I., improved; S.I., slightly improved; U., unchanged; W., worse. Par. = paranoid schizophrenia; Heb. = hebephrenic schizophrenia; Cat. = catatonic schizophrenia; Invol. = involutional melancholia; M–D., = manic-depressive psychosis; Ep. = epilepsy; P.P. = post-encephalitic parkinsonism; G.P.I. = general paresis.

It is also seen that the highest proportion of improved cases occurs in the catatonic patients. The paranoid group follow closely and there is a considerably lower ratio of improvement in the hebephrenic subdivision. No hebephrenic patient of the present series can be classified as "much improved," and 2 of them are among the 4 "worse" patients. Of the 3 patients with an affective psychosis, 2 are "much improved." Two of the 3 epileptics have improved slightly, as has the single example of general paresis.

Table II shows the results according to the duration of the illness. This factor and post-operative improvement appear to be in inverse ratio, but on

TABLE II.—*Results According to Duration of Present Attack*

Duration.	Number treated	Improved.	Unimproved.
Under 2 years	5	4	1
2–4 years	17	13	4
5–9 ,,	26	16	10
10–20 ,,	20	11	9

statistical examination the difference between the two groups is not significant. An investigation of larger numbers would appear to be indicated.

The average age at operation of those patients showing improvement was slightly higher than that of the unimproved patients, 37·8 as opposed to 35·8 years. When the sex-distribution of improvement is reviewed a marked difference between the sexes is apparent. Of the men, 29 are to some extent improved out of a total of 36 undergoing operation. The corresponding figures for women are 15 patients improved out of 32 leucotomized.

CLINICAL ASSESSMENT.

(a) *Schizophrenia.*—If the effect of the operation on the clinical picture is discussed in greater detail, the large group of schizophrenics with their varied symptoms is difficult to present. It is obviously impracticable to describe the progress of each patient, while if considered in general terms much of special clinical interest is necessarily lost. A compromise is here attempted by discussing the effect on certain typical symptoms followed by a few examples of patients' histories given in outline.

Three of these examples of schizophrenic patients in the different categories of improvement also serve to illustrate relapse.

Thirty-nine cases of schizophrenia are reported as being to some extent improved. In one half of the patients in whom hallucinations and delusions were prominent before operation these features are still present, but in attenuated form. In a quarter they have disappeared and in a like proportion they remain as marked as before operation. Whether they are modified or intact the patients tend to act on their delusions no longer and to take the view that it does not matter what their "voices" say. Persistent aggression has been lost and violent outbursts no longer appear or do so infrequently and in a modified form. In 3 catatonic patients periodicity has been absent since leucotomy. The effect of the operation on disorders of thought is less apparent. They were not reported as prominent features in all these patients. They cleared up after operation in half the cases in which they had been present, but were little changed in the remainder. The same improvements were also seen for a period in 11 of the 17 schizophrenic patients now classified as "unchanged."

CASE 36.—Mr. F. T—, aged 57; retired Army officer.

Premorbid personality.—Little information is available. A Guards officer, he was considered to be effeminate and he did not mix easily with his colleagues. He did well during World War I but was retired after hostilities ceased.

Duration.—(*a*) Of illness, 15 years; (*b*) of present attack, same period; (*c*) of hospitalization, from 28.ix.35.

Diagnosis.—Paranoid schizophrenia.

Previous treatment.—No physical therapy.

Pre-operative state.—He had well-systematized delusions of persecution for many years and was probably hallucinated. He was a most difficult nursing problem, a window-smasher and successful escapist. He made many attacks on the staff and patients. He was unoccupied except for going for long walks, keeping a scrapbook and writing scurrilous letters.

Operation.—11.x.45: Coronal cut.

Complications.—Nil.

Progress.—12.xi.45 : He has ideas of victimization and illegal detention, but displays less emotional tension. He is sociable and cheerful, and attends O.T. classes.

11.iv.46 : Continued improvement. He writes and talks less about his detention.

10.x.46 : He is active and sociable, friendly towards his wife and the staff and has full parole.

Reassessed, April, 1947 : He makes good use of his parole. He does not complain spontaneously of detention, but when questioned protests quietly without emotion. The patient accepts advice to remain in hospital until home conditions are more suitable.

Post-operative signs.—Somnolence. Elevation of mood.

Rehabilitation.—Occupational therapy. Social activities. Parole.

Result.—Much improved.

Case 38.—Mr. J. C—, aged 32 ; Army officer.

Premorbid personality.—He was a shy, timid and solitary youth. Above average scholastically, he acquired some competence at games, but made few friends. His service record was good.

Duration.—(*a*) Of illness, from 1942 ; (*b*) of present attack, same period ; (*c*) of hospitalization, from 1943.

Diagnosis.—Schizophrenia, hebephrenic.

Previous treatment.—E.C.T., 1943, with improvement. Insulin 50 comas, 1945–46, no change.

Pre-operative state.—Thought disorder was apparent, and hypochondriacal delusions and auditory hallucinations were marked. The patient retained some insight and was willing to co-operate. He occasionally attended classes.

Operation.—28.iii.46 : Horizontal cut.

Complications.—Nil.

Progress.—28.iv.46 : He is quiet, asocial, irritable at times. He is less restless and his hypochondriasis is less marked.

28.ix.46 : Little change. He is doing farm work.

Reassessed, April, 1947 : The patient hears both male and female voices, but is not interested in them. He is much less concerned about his " tummy." Still manneristic and withdrawn ; he is polite and amenable, attends classes and takes much exercise.

Post-operative signs.—Irritability. Elevation of mood.

Rehabilitation.—Occupational and recreational therapy. Farm work. Parole.

Result.—Improved.

Case 43.—Mr. R. C—, aged 52 ; labourer.

Premorbid personality.—An average scholar, he later had many jobs, but persevered with none. He had normal social interests. Was quick tempered, but could exercise control.

Duration.—(*a*) Of illness, 3 years ; (*b*) of present attack, 7 months ; (*c*) of hospitalization, intermittent since 29.vi.44.

Diagnosis.—Paranoid schizophrenia.

Previous treatment.—E.C.T., 1944, on two occasions with remission ; in 1945 without improvement.

Pre-operative state.—He was sullen and unco-operative, often very aggressive, restless and suspicious. Delusions of a persecutory nature were very prominent.

Operation.—8.ii.45 : Coronal cut.

Complications.—Nil.

Progress.—15.iii.45 : No longer suspicious or deluded, he is generally euphoric, friendly towards his wife and with only fleeting irritability. He refuses to occupy himself.

17.v.45 : Not irritable now. He has attended classes and is friendly and co-operative. His wife considers him to be his normal self. Discharged.

30.v.46 : Seen at O.P.C. He has been relapsing for the past few months into his previous aggressive and deluded state.

12.ix.46 : Readmitted ; suspicious, sullen with paranoid delusions and auditory hallucinations.

Reassessed May, 1947: He has lost his aggression, shows no signs of hallucinations and denies ideas of reference or persecution. He is idle and unco-operative.

Post-operative signs.—Confusion, restlessness. Transient euphoria. A more lasting elevation of mood. Increased inertia.

Rehabilitation.—Occupational therapy. Parole. Discharge.

Result.—Slightly improved.

CASE 28.—Miss M. T—, aged 28; nurse.

Premorbid personality.—She was a bright and active child, who did well at school. She trained in domestic science and became assistant matron of a college. Later she began nursing and then showed undue anxiety and an over-conscientious attitude. She was reserved, but popular with her fellows.

Duration.—(*a*) Of illness, 7 years; (*b*) present attack, same period; (*c*) of hospitalization, from 1940.

Diagnosis.—Schizophrenia, hebephrenic.

Previous treatment.—Insulin, 27 comas, 1940, with considerable improvement. Cardiazol and E.C.T., 1941, with slight improvement.

Pre-operative state.—At her best she was facile, self-absorbed, lacking in initiative, with emotional blunting and apparent intellectual deterioration. At times she was aggressive and assaultive, and this phase was becoming increasingly frequent and was unaltered by E.C.T.

Operation.—29.vi.44: Coronal cut.

Complications.—Nil.

Progress.—29.vii.44: Hallucinated and preoccupied, but no longer destructive or aggressive. She responds to stimulation.

29.xii.44: No marked change, but she is now attending classes.

29.vi.45: She is again destructive and at times aggressive, but less than before.

29.vi.46: There has been further regression. She requires heavy sedation at times and is otherwise idle.

Reassessed, March, 1947: She is solitary, self-absorbed, and idle; answers questions briefly, smiling incongruously. Frequently noisy, hallucinated and impulsive.

Post-operative signs.—Confusion. Restlessness. Transient elevation of mood.

Rehabilitation.—Occupational and recreational therapy. E.C.T.

Result.—Unchanged.

CASE 26.—Miss B. S—, aged 36; at home.

Premorbid personality.—No information available.

Duration.—(*a*) Of illness, 12 years; (*b*) of present attack, same period; (*c*) of hospitalization, from 1935 with two short breaks.

Diagnosis.—Schizophrenia, hebephrenic.

Previous treatment.—Triazol, 1939, with improvement. Insulin, 1940 and 1942, with improvement. E.C.T., 1942, no change.

Pre-operative state.—She was idle and self-centred, lacking in spontaneity and irrelevant in her answers. Mainly amenable, she had occasional impulsive phases. She required supervision at meals and toilet.

Operation.—7.x.43: Coronal cut.

Complications.—Nil.

Progress.—7.xi.43: Improvement in appearance and in personal habits.

7.iv.44: She lacks spontaneity and has only superficial interests, but is fully occupied and behaves well.

7.x.44: She lives contentedly from day to day and is only infrequently aggressive and then to a less extent than previously.

21.i.45: She left hospital on probation.

22.iii.46: Readmitted, euphoric, lethargic, at times hallucinated.

Reassessed, March, 1947: In August, 1946, she became restless, manneristic and more constantly hallucinated. She improved after E.C.T., but has required maintenance treatment to date.

Rehabilitation.—Occupational and recreational therapy. Social activities. Holidays and probation. E.C.T.

Result.—Worse.

(b) *Other diagnoses.*—In one epileptic, 3½ years after operation, psychic equivalents are still present, but are less severe and less frequent. The second patient in this group is also less aggressive, although irritability is occasionally seen. Grandiose delusions and excessive religious zeal, previously prominent, are now in the background. The third epileptic is unchanged. Her furors continue after a brief period of betterment following operation.

One involutional melancholic has lost his depression, hypochondriasis and suicidal ideas. Discharged five months after operation he failed to adapt to his home environment and was readmitted to hospital. Now, two years after leucotomy, with more successful rehabilitation, discharge is again contemplated. The other patient with this diagnosis is classified as unchanged four years after operation. She is still depressed, with alternating apathy and agitation. In this case amelioration after operation lasted eleven months before relapse.

The single case of manic-depressive psychosis showed true cyclothymic swings, sometimes with brief interludes of normality. After operation the periodicity vanished and there was a gradual improvement in adaptation up to two years, when manic phases reappeared. Now, three years after operation, the patient has been at her best level for four months.

The patient suffering from parkinsonism is quite unchanged. Her abusive and violent outbursts remain as before. She is being considered for re-operation.

Three and a half years after leucotomy the general paretic is only occasionally hallucinated and then with much less affect. His grandiose ideas are more in the background.

Post-operative Complications.

Troublesome sequelae immediately after operation were few. Respiratory distress occurred in several cases, but yielded to the administration of oxygen and 5 per cent. carbon dioxide. Post-operative vomiting was more frequent, but seldom persisted after the first twenty-four hours.

Signs of meningeal irritation occurred in two cases ; in one on the third post-operative day, in the other not until the sixteenth day. In both instances the condition was rapidly controlled by oral administration of sulphonamide.

Post-operative Signs.

The occurrence of specific mental changes following damage to the frontal lobes of the brain has been discussed by many writers. It is not easy to classify all the changes which occur. Some of them could be interpreted in various ways, some appear to merge into one another. Ten post-operative findings are described here. Of these the first five are early and transient, while the remainder tend to occur a little later and in some instances to be permanent. Temporary symptoms, such as disorientation, somnolence and restlessness are probably due to the effect of the operation on general brain function. There is no evidence to show that these signs are specifically frontal in origin.

Post-operative confusion included disorientation, lack of appreciation of the passage of time, drowsiness. Its duration seldom went beyond several days.

Restlessness occurred in a third of the cases in the immediate post-operative phase. It generally took the form of picking at the bed-clothes or bandages, although in a few cases it went so far as to make difficult the control of the patient in bed. Restlessness lasted longer than confusion.

Lack of facial expression, monotonous voice, disinclination to sustain a conversation with at the same time the exaggerated politeness described by Frank (1946) made a common post-operative picture, which may be termed "over-polite reticence."

In a few cases there was a rapid transition from the state just described to one in which features of disinhibition were prominent. The latter more frequently occurred after one or two weeks had elapsed. Its characteristics were a cheerful familiarity, "Witzelsucht," shouting, singing; occasionally obscene language appearing for the first time, in one case sexual advances also for the first time. These florid features were of short duration.

Incontinence of urine occurred in the great majority of cases for the first few days. In six patients it persisted for several weeks or months. One patient whose toilet habits before operation had been faulty was incontinent occasionally for two years when this tendency faded out.

Irritability appeared in ten patients towards the end of the first post-operative month and reached its maximum in the second or third month. Thereafter, in most instances, it gradually became less noticeable. In two cases its duration was longer than usual and was a factor militating against social adaptation.

Euphoria may be defined as an exaggerated feeling of well-being. Where it occurred post-operatively it did so at an early date and in most cases persisted. In a few patients euphoria faded after several weeks or months, but the sustained mood still remained at a higher level than before operation.

An elevation of mood, varying in degree, not amounting to euphoria but resulting in a freedom from tension, was the commonest post-operative finding. This sign made an early appearance and in the majority of cases it persisted.

Apathy, indolence, lack of initiative and drive are included under the heading "inertia" and appeared in 28 cases. Such findings are common in chronic cases of schizophrenia, and it requires special care to demonstrate them as sequelae of the operation. Only when they made their first appearance after leucotomy, or were then present to a definitely greater degree, are they taken into account here. In this series inertia showed a tendency to persist, in some cases to increase.

Changes in the higher differentiated feelings concerned with ethical and social conduct have frequently been described. They are of the nature of a slight but definite blunting. A few such changes could be detected in those patients who had improved since operation. Tactlessness was a failing in two patients. In two there was a lack of emotional appreciation of the future. Diminished self-consciousness was present in two patients, both of whom showed a tendency to flirtation with the opposite sex. This trait was quite foreign to their pre-operative state and also to their schizoid prepsychotic personality. A decrease of the self-critical factor was evident in six patients, who manifested moral changes which included lying, petty pilfering (2), extravagance of money (2) and homosexual behaviour. The majority of these features appeared in phases, although a few seem to be permanent personality changes.

The most important frontal lobe symptoms are those concerned with affect and volition. In the emotional sphere two findings fall to be considered, euphoria and elevation of mood to a lesser degree. Inertia is the volitional change which merits attention. These three main findings are extracted and their persistence and distribution in all categories of improvement is set out in the following table.

TABLE III.—*Main Post-operative Signs in* 68 *Cases.*

Result.	Number.	Euphoria.		Lesser elevation of mood.		Inertia.	
		Transient.	Persistent.	Transient.	Persistent.	Transient.	Persistent.
M.I.	6	1	3	—	3	1	2
I.	10	—	3	—	7	1	4
S.I.	28	1	4	—	24	2	14
U.	20	—	—	13	—	1	—
W.	4	1	—	—	2	—	3
Total	68	3	10	13	36	5	23

Where a patient has improved, tension has been lost and the mood is raised, in some instances to euphoria. In the improved cases the mood has remained elevated. In the majority of the " unchanged " cases it has risen transiently, although in some patients under this heading no such change could be detected. The other main post-operative sign, inertia, serves in some cases as a counterbalancing factor. Where permanent, inertia may, even in the presence of raised mood, cause a case to fall into the category of only " slightly improved." Where it is marked and persistent the patient may even be deemed " worse." The result in any one case depends on the proportions of three factors, raised mood, inertia and the residue of the psychosis.

After-treatment.

The importance of after-care of patients is stressed by most writers on leucotomy. Opinions differ as to whether the burden of rehabilitation should be borne by the family or by the hospital. The policy of this hospital is to prolong the period of convalescence in the institution, the average period for successful cases being about six months. The regime of re-education with its emphasis on individual care has been described by Berliner *et al.* (1945).

It goes without saying that the best results of after-care will not be seen in the patients of this series. In a few cases the clinical state after leucotomy had altered so little that no re-educative measures were possible. For the majority a programme which included individual attention in the occupational, recreational and social spheres was initiated and continued until it was clearly seen that further improvement by this means was not to be expected. A few patients followed the routine successfully up to discharge only to return to hospital at a later date. It is obvious that no amount of rehabilitation will do much to help a patient whose psychosis has not lost its emotional charge or one in whom tension has been relieved, but who has developed a persistent lack of initiative.

Electroconvulsive treatment was given post-operatively to 46 of the 68 patients. Its effect was to cut short isolated impulsive outbursts and in 12 cases to alter favourably the clinical picture in a relapse. Electroplexy had little effect in initiating improvement or in increasing it. In the majority of cases its effect was no more permanent after operation than before, although by maintenance treatment a few patients could be kept at a higher standard of mentation and behaviour than before leucotomy.

No case among the 68 was thought to be suitable for insulin coma therapy after operation. Two were submitted to re-operation and in both cases a degree of improvement followed it. In both cases the coronal cut was employed at the first operation. In one, at re-operation, the lower half of the same line of section was followed. At the point of entry the leucotome was turned horizontally and the incision was continued anteriorly to complete the " horizontal cut." In the other a second coronal cut was made from a point of entry 1 cm. below and in front of the original one.

Relapse.

This question involves more than consideration of the "unchanged" patients who have failed to maintain a temporary improvement. Minor fluctuations of behaviour were common and are not considered here. Relapse is taken to mean a close approximation to the pre-operative state and as such it occurred in 30 patients of the series after an average period of nine months had elapsed. In 14 of these regression was permanent. In the remainder, after an interval of a few months, improvement again took place. Figures in the different categories are as follows:

Much improved: 3 of the 6 patients now in this group relapsed after gradual improvement over one to two years. One of them had been discharged.

Improved: 3 patients under this heading returned to their pre-operative state after periods of from three to ten months. Two of them relapsed while at home.

Slightly improved: 10 patients in this category relapsed two to sixteen months after operation, two of them while at home.

Unchanged: 13 patients relapsed after intervals varying from two to twelve months., One of these patients had been able to go home.

Worse: one patient relapsed while at home two years after leucoctomy.

It will be seen that 7 unsuccessful discharges are included in the relapsed cases. In addition, 2 discharged patients could not be considered to have relapsed in the strict sense of the term, but in part owed their return to hospital to the acquisition of symptoms such as irritability, inertia, tactlessness and lack of consideration for others. The 9 patients remained at home for periods varying from two and a half to twenty months. When re-admitted they had been regressing for several weeks, in one or two cases for several months. In 3 cases the home environment was clearly a major factor in precipitating a relapse, in the others it may have played some part.

Where true relapse occurred the returning psychosis largely blotted out the new personality features which the patient had acquired since operation. The elevated mood was lost although inertia showed a tendency to remain in some cases and so to modify the clinical picture. Of the 16 patients who overcame a temporary setback, 12 received E.C.T. In half of this number a single course of treatment was followed by improvement. The other 6 required repeated courses or maintenance treatment before the beneficial effect of leucotomy was given permanence. The remaining 4 cases of the 16 subsequently regaining a better level, and the 2 showing marked frontal lobe symptoms required no more active treatment than continued rehabilitation in the sheltered hospital environment.

Post-operative Epilepsy.

Epileptiform fits occurred for the first time in six leucotomized patients. All of them had received electroconvulsive treatment before leucotomy. In three cases there were single major convulsions taking place, 9, 10 and 16 months respectively after operation. Only the second case had been given electroplexy post-operatively, and this treatment had consisted of several short courses which were terminated six months before the appearance of the spontaneous convulsion. Two patients had two major fits, in one instance on the same day, in the other with an eleven-day interval. These appeared nine months and two years and ten months respectively after operation. In both cases convulsive therapy had been given on a maintenance basis following leucotomy, but had not been administered for several months before the spontaneous seizures occurred. In the only case where epilepsy showed a tendency to persist it first developed two years and six months after leucotomy. Post-operative E.C.T. had been given, but seventeen months separated its termination and the onset of epilepsy. In all, six major convulsions have occurred to date, at approximately monthly intervals for the first four fits, latterly with intervals of several months. This last patient received a bromide and chloral mixture, two of the others were given phenobarbitone and the remaining three patients received no anti-convulsive treatment. Rizatti has stated that leucotomized patients later developing epilepsy continue to improve mentally. Of these six patients one is classified as "improved," two as "slightly improved," two as "unchanged" and one as "worse."

Four cases of epilepsy, one of them also a schizophrenic, are among the 68 patients of the series. In one of them fits have been less frequent since operation, the others have shown no significant change in the rhythm or frequency of their seizures.

Changes in Personality.

The material of the series does not permit of much contribution to the extensive literature on this question. Frankl and Mayer-Gross have suggested that leucotomy acts by superimposing a modified frontal lobe deficiency syndrome on the existing psychosis and therefore the prepsychotic personality should not have a decisive influence on the final result. Study of the present series lends some support to this view. Symptoms of frontal lobe deficiency and of the original psychosis are found side by side in the great majority of patients. No relationship was found between the nature of the pre-psychotic personality and the patient's response to the operation, and no post-operative trait could be traced back to the character of the patient before his illness.

As the cases under consideration were generally unsuitable for intensive psychological testing, both before and after operation, nothing can be said regarding changes in intellectual functions except that clinically there was no deterioration after leucotomy.

Changes in Body-weight.

Increase in weight may be counted as the most striking vegetative manifestation of frontal lobe deficiency. It is associated with a voracious appetite. The latter has been accounted for by the lack of visceral distress which these patients show ; they fail to recognize the fullness of the stomach after an adequate meal. Decreased self-consciousness and self-criticism with no fear of fatness, may play a part. Freeman and Watts (1942) have stated that post-operative increase in weight is more marked in women than in men. Lyerly is reported by these authors as finding a high correlation between gain in weight and improvement in the mental state.

In this series satisfactory weight-records were available for 62 patients, half of whom were male. Twenty-four patients of each sex gained weight post-operatively and the average initial gain was approximately the same, 20 lb. for men and 19 lb. for women. In some cases there was a gradual increase over many months, but the commonest finding was an initial increase reaching its peak in the fifth to eighth month. Thereafter, in most cases, the weight decreased, but still remained above the pre-operative level. The maximum gain reported was 47 lb. This occurred in a " much improved " patient after eight months, but an equal increase was made over twenty-one months in a patient classified as " worse." No relationship could be traced between improvement and increased body-weight. The different categories of improvement are distributed among those who gained weight, permanently or transiently, and the 14 whose weight either decreased or showed no significant change after operation. Of the latter group, eight are classified as being in some degree improved. Weight records over four years are available for a few cases. One patient (slightly improved) with a gain of 7 lb. in the first three months had increased by an additional 10 lb. after four years. Another (improved) who had gained 19 lb. in the first five months had returned to his pre-operative weight at the end of four years.

Factors Influencing Prognosis.

In the view of Freeman and Watts (1946) certain general factors influence prognosis with leucotomy regardless of the psychiatric classification. Among these are the pre-operative degree of mental tension and of break with reality. With behaviour as a guide, different degrees of tension and break with, or withdrawal from, reality can be made out. In making individual assessments of the two factors, maximal tension or reality-break was equated with unity, minimal with $\frac{1}{3}$ and an intermediate degree was recorded as $\frac{2}{3}$. A percentage of the total possible score for each factor was obtained in two groups of patients, the 44 who improved and the 24 who failed to do so. The degree of tension in the improved group gave a percentage figure greater than that in the unimproved group and statistical examination showed the difference between the two figures to be significant. The percentage figure for the degree of break with reality was greater in the unimproved group, but the difference between the figures for the two groups was not statistically significant.

COMMENT.

Various authors have reported successive stages in the recovery of patients following operation. It is perhaps more accurate to say that some post-operative signs appear early and some later, but once the immediate post-operative phase is over there is no hard and fast sequence. Improvement, especially in schizophrenia, is certainly gradual and it should be stressed that the results in this series cannot be considered as final at the time of reporting.

As presentation of the results of the hospitalized patients alone gives an incomplete picture of the effects of the operation it is proposed to combine them with the results of Frankl and Mayer-Gross. Of 68 patients discharged these authors found 7 whom they considered to require readmission to hospital. These have been added to the " unchanged " group, which means putting their post-operative status at probably its lowest level. For the total of 136 patients the results are therefore 61 socially recovered, 6 much improved, 10 improved, 28 slightly improved, 27 unchanged and 4 worse. Percentage figures for the combined group are 45 per cent. recovered, 32 per cent. improved, 20 per cent. unchanged and 3 per cent. worse. These results compare favourably with those for 1,000 cases published by the Board of Control (1947). This larger series is similar to the present one in that cases of schizophrenia were in a majority, although to a less extent than among the 136 patients. Freeman and Watts (1946) for 331 cases report results to be good in 52 per cent., fair in 32 per cent. and poor in 13 per cent, but almost two-thirds of their patients suffered from involutional psychoses, obsessive states or psychoneuroses. The same authors also in 1946, from a study of 65 cases of schizophrenia predict results to be good in 31 per cent., fair in 27 per cent. and poor in 41 per cent., where the duration of the illness is over two years.

It is felt that more should be said of those patients considered to be worse after operation. Four may seem to be a high proportion of a small series. The term itself may be to some extent misleading. As slight improvements in behaviour have been noted, so also have all deteriorations. In the case of one patient, no more is meant by "worse" than that a man previously able to work at occupational therapy is now unable to do so. Another is similar, but with the addition of post-operative epilepsy. In a third male brief periods of relative remission present before operation have disappeared. The presence of frontal deficiency signs suggests that the operation has left its mark on these schizophrenics of long standing and that post-operative inertia is responsible for their present stage. In the single female schizophrenic in this category post-operative tension is greater than pre-operative and it appears that the operation has failed to check a progressive illness.

Examination of the results entails comparison between the 44 improved and the 24 unimproved patients and comparison between the whole group of hospitalized patients and the equal number of those who have been discharged. The results of the operation are stated by Freeman and Watts (1946) to be better in elderly patients than in the young on the grounds that the personality breaking down earlier is the more fragile. The age at operation would hardly seem to be an important prognostic factor in chronic psychotic patients hospitalized for many years, and there was little difference in the average age of those improved and unimproved, remaining in hospital or discharged.

Duration of the illness may have more bearing on the prognosis. In Table II this factor appears to be in inverse proportion to post-operative improvement, but statistical examination of the figures does not bear out that the trend is a significant one. When the two series of 68 patients are compared the differences are even less striking. When the duration of the present attack is less than 2 years, 5 patients are found to be in hospital and 8 discharged. When it is from 2 to 4 years, 17 are hospitalized against 18 discharged. With a present attack lasting from 5 to 9 years, 26 patients of each group are found. From 10 to 20 years, 20 remain in hospital and 16 are discharged. The average duration of illness of discharged patients was 6·4 years, of improved patients in hospital 7·5 years, and of unimproved 9·2 years.

The sex-distribution of improvement shows interesting if somewhat inexplicable results. In the hospitalized series patients showing improvement numbered 29 men and 15 women; those regarded as unimproved, 7 men and 17 women. The series of 68 discharged patients consisted of 28 men and 40 women. Totals for the two series are 64 men and 72 women. Female patients show a marked preponderance in the best and poorest categories of improvement. Frankl and Mayer-Gross have explained the greater number of female discharges by pointing out that one would expect women to be taken out of hospital more easily than men after a long illness. If this assumption is granted there follows a levelling-up of the sexes among those patients responding favourably to operation. Some of the group of 29 men who have improved have probably reached the standard attained by the women who have been discharged. Because of the greater responsibilities which await them in the outside world they are not yet considered fit to leave hospital. It is less easy to explain why there should be a female preponderance amongst those who have failed to improve. The material published by the Board of Control showed better results in males, but the author pointed out that it did not seem reasonable to assume a sex differentiation in the results of the operation.

Findings are more definite when the diagnostic classification is considered. Nine-tenths of the hospitalized group are schizophrenics as against three-quarters of the discharged. There is no obsessional illness among the hospitalized and only three examples of affective psychosis, while the number of non-schizophrenics of these two categories among the discharged is 17. The schizophrenic patients remaining in hospital include 15 catatonic, 27 paranoid and 18 hebephrenic patients. The figures for the discharged group are 24 catatonic, 19 paranoid and 7 hebephrenic and simplex cases of schizophrenia.

The importance of pre-operative mental tension as a prognostic factor has been sufficiently stressed. In the series of 68 patients in hospital a mathematical assessment shows the group reacting better to the operation to have had greater tension. This bears out the well-established clinical opinion. A break with, or withdrawal from, reality which has also been considered to have prognostic significance was found to be harder to assess. The impression in regard to this factor was not susceptible of proof.

To sum up: There is no ready explanation for the partially successful or completely unsuccessful results among these 68 patients. It has been seen that among those reacting favourably to leucotomy are more cases of affective and obsessional illness, and of the catatonic and paranoid types of schizophrenia. Among those reacting unfavourably are more examples of schizophrenia itself and of the hebephrenic type in particular. Tension is greater and duration may tend to be less where the response is good. The prepsychotic personality has little bearing on the post-operative state of those patients remaining in hospital however it may modify the behaviour of those who have been discharged. There is, in short, no common factor running consistently through the groups of discharged and hospitalized, improved and unimproved. Indeed, in all these groups cases can be found with the same diagnosis, a similar duration and a comparable degree of tension. Frank (1946) considers leucotomy to be indicated and most successful in patients whose psychosis is sudden in onset, precipitated by psychological or physical trauma, and characterized by plasticity of symptoms and a cyclic tendency. It has been pointed out by Nolan Lewis (1946) that these factors have for many years been emphasized as favouring a good prognosis regardless of the type of therapy employed. The present writer finds himself in agreement with the latter half of Freeman and Watts' dictum: "In schizophrenia the percentage of patients in whom there will be good results may be predicted, but which individual patient will be improved cannot be determined." It seems certain that what may be called the accident of the operation has much to do with the clinical result. Meyer and Beck (1945) have drawn attention to the considerable variation in the plane and depth of the cut even although the surgeon thought he was carrying out the operation in standard fashion. There are certainly grounds for believing that with the present "blind" procedure no two patients will have an exactly similar amount of frontal lobe isolated.

DISCUSSION.

The Problem of Relapse.

The literature of prefrontal leucotomy makes only brief mention of those patients who relapse after operation.

As the rationale of the operation itself has not yet been placed beyond doubt it is not surprising that no theories have yet been advanced to explain the mechanism of relapse. Cobb (1943) holds that improvement after leucotomy is due to the reduction of the number of possible circuits for association. The spread of stimuli to different cortical areas is thereby limited and the integration of present stimuli with past memories and habitual responses prevented. With too limited an operative procedure the disintegration may be minimal and the environment may assume great importance. In three of the nine cases discharged unsuccessfully, home circumstances appeared to precipitate a relapse and in some others the same factor could have played a part. The infinite lability of the nervous system has been stressed by Golla (1943). New pathways may take over the functions of the cut fibres. If this process in some cases leads to satisfactory social adaptation, it is equally possible that in others it may lead to relapse.

The question of relapse is closely linked to that of after-treatment and it has been shown above that electroplexy controlled impulsive outbursts and helped 12 patients over a relapse. Wider claims made by other writers for post-operative E.C.T. were not substantiated. The other major physical treatment used in this connection was a repetition of the operation itself made with benefit in two cases two years after the first leucotomy. It is felt that if gradual improvement and a fluctuating post-operative course are given due recognition in chronic psychotic patients re-operation might be considered more frequently when there is otherwise no reasonable hope of further betterment.

The Role of Leucotomy in Chronic Psychosis.

Moniz' procedure does not have a specific action on disease entities but acts primarily on their symptoms. Results in the small non-schizophrenic group confirm previous findings. It is generally accepted that there will always be a few cases of affective psychosis which prove refractory to convulsive treatment, and that these cases do well with leucotomy. Although the operation may be followed by epileptic convulsions it appears to have little effect on the rhythm of the seizures of established epilepsy. Hofstatter *et al.* (1945) noted that the behaviour disturbances in epilepsy may sometimes be modified and this has been achieved in two of the three cases considered here. Thorpe (1946) has reported improvement in the disordered behaviour which follows encephalitis, but the single case of post-encephalitic illness in this series is quite unchanged. It must be seldom that patients suffering from general paresis are submitted to operation. Here, as in schizophrenia, relief from tormenting hallucinations has been obtained.

The role of the operation in schizophrenia may be considered at greater length. Parker (1946) stated that "in schizophrenia, paranoia and paraphrenia it is doubtful whether leucotomy is more efficacious than other methods of treatment." The point should be made that where other methods have been tried and repeated without success, leucotomy still offers hope of improvement. This may range from freedom from distress to social recovery and will include the majority of those brought to operation. The optimum time for operation is generally held to fall after the other physical therapies have failed and no reasonable hope of a spontaneous remission remains. But even when the disease has been present for years and has progressed to deterioration the patient may still be susceptible of improvement as long as he is still distressed by his illness. Schizophrenic deterioration is a common clinical concept and is generally taken to mean a progressive disintegration of the total personality with gross defect in volition, emotion and the thought-processes. Freeman and Watts (1946) state that, "a deteriorated schizophrenic looks and acts about the same with or without his frontal lobes." This dogmatic statement merits examination. As a rule of thumb these writers "employ three criteria in judging the emotional responses of the patient: severity of complaints, disturbing behaviour and autonomic imbalance. When none of these is present the patient is too deteriorated to warrant operation." Deterioration in the emotional field is therefore the contraindication found by these authors. They would appear to be describing the flat, "burnt-out" schizophrenic. Most psychiatrists would agree that such a patient is unsuitable for operation. But many of the schizophrenic patients of the present series before leucotomy were deteriorated in the sense in which that term is commonly used. Many were withdrawn and barely accessible, dissociated and incoherent in thought. Some had faulty personal habits. Some, for part of the time, showed flattened or incongruous affect, but the great majority were subject to bouts of violent or disturbed behaviour. The changes following leucotomy have been described. The 68 patients may be failures in that they have not attained recovery; but almost two-thirds of them have been freed from emotional tension and distress.

Summary and Conclusions.

1. The results of prefrontal leucotomy are reported in 68 cases of a chronic mental illness still resident in a mental hospital after a post-operative period of from one to four years. Of these, 44 patients improved in varying degree and 24 are considered to be unimproved. These results are analysed in terms of age, sex, duration of the illness, diagnostic classification.

2. Post-operative signs are listed and the main findings are seen to be euphoria, an elevation of mood to a lesser degree and inertia. The occurrence of these signs of frontal lobe deficit is charted in relation to improvement and their effect in modifying the psychosis is described.

3. After-treatment includes E.C.T. and re-operation and the effect of these measures on relapse is described. Regression occurred transiently in 16 patients and permanently in 14 patients. Its theoretical aspects are discussed.

4. Changes in body-weight following leucotomy are described. No correlation is found between increase in weight and improvement in mental state.

5. Two factors in the pre-operative state thought to influence the prognosis are examined in relation to post-operative improvement. Those cases which improved after leucotomy had in aggregate a greater degree of mental tension than those not improving. No such prognostic significance could be attached to the other factor, the degree of break with reality.

6. The lack of finality in the reported results is mentioned. The results in a combined group of 136 patients, discharged and hospitalized, are compared with the results published by others. The significance of the result " worse " is discussed.

It is concluded that leucotomy acts by removing mental tension and that where this is marked there is hope of improvement even if the patient is considered to be " deteriorated."

It is further concluded that while mental tension tends to be greater where the response to operation is good, there is no common factor or group of factors in those patients who improve or fail to improve after leucotomy. The results in individual cases of chronic mental illness are at present unpredictable before operation, but the value of this method of treatment in such cases is fully confirmed.

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I am indebted to Dr. P. K. McCowan for permission to publish this material and for helpful criticism; to Mr. R. L. Beveridge who operated on most of the cases, and to Dr. W. W. Roberts for help in the statistical treatment of some of the results. My special thanks are due to Dr. W. Mayer-Gross for his unstinted advice and interest.

REFERENCES.

BERLINER, F., BEVERIDGE, R. L., MAYER-GROSS, W., and MOORE, J. N. P. (1945), *Lancet*, **2**, 325.
BOARD OF CONTROL (1947), *Prefrontal Leucotomy in 1000 Cases*. London.
COBB, S. (1943), *Borderlands of Psychiatry*. Cambridge, Mass.
EGAN, G. P. (1949), *J. Ment. Sci.*, **95**, 115.
FRANK, J. (1946), *ibid.*, **92**, 497.
FRANKL, L., and MAYER-GROSS, W. (1947), *Lancet*, **2**, 820.
FREEMAN, W., and WATTS, J. W. (1942), *Psychosurgery*. Springfield, Ill.
Idem (1946), *Amer. J. Med. Sci.*, **211**, 1.
Idem (1946), *South. Med. and Surg.*, **108**, 241.
Idem (1946), *Progress in Neurology and Psychiatry*, **1**, 649.
Idem (1947), *ibid.*, **2**, 461.
GOLLA, F. L. (1943), *J. Ment. Sci.*, **89**, 189.
HOFSTATTER, L., SMOLIK, E. A., and BUSCH, A. K. (1945), *Arch. Neurol. Psychiat.*, **53**, 125.
LEWIS, N. D. C. (1946), *The Yearbook of Neurology, Psychiatry and Neurosurgery*. Chicago.
MEYER, A., and BECK, E. (1945), *J. Ment. Sci.*, **91**, 411.
MOORE, N. P. (1943), *ibid.*, **89**, 257.
PARKER, C. S. (1946), *ibid.*, **92**, 719.
RYLANDER, G. (1939), *Personality Changes after Operation on the Frontal Lobes*. London.
THORPE, F. T. (1946), *Brit. Med. J.*, **1**, 312.

PRELIMINARY REPORT OF CHANGES AFTER PREFRONTAL LEUCOTOMY.*

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Introduction.

Considerable material is available about the effect of leucotomy on intelligence. There are, however, few reports of objective measures of changes after leucotomy in the non-intellectual aspect of personality, those changes of temperament and character which are so striking to the clinician. In order to make a small contribution to filling this gap, at the suggestion of Dr. Desmond Curran an investigation has been carried out at St. George's Hospital and its In-Patient Unit at the Atkinson Morley Hospital, London.

On examining the literature, and reading of the changes that have impressed themselves upon clinicians, psychologists, and the family and friends of patients, the hypothesis was formulated that the changes noted embraced at least three aspects of personality. These were, intelligence, degree of neuroticism, and degree of neurotic introversion ; that is the intensity of the anxious and depressive traits. It was further thought that the changes would be in the direction of a decrease in intelligence, a decrease in neuroticism and a movement away from extreme introversion, towards the extravert end of the scale. The results presented here lend support to these expectations.

Sample.

Since the beginning of 1947 each patient recommended for leucotomy at the above-mentioned hospitals has been examined on an extensive group of personality and intelligence tests. This report deals with differences found on 20 patients (4 males and 16 females) tested before and two to three months after the operation. The neuro-surgeon was Mr. Wylie McKissock, whose technique is described in *The Lancet* (1943).

The average age of the patients was 41·5 years, and the mean Wechsler I.Q. was 105·87. The patients were described as depressed, anxious, obsessional or paranoid.

It is important to mention that, from the point of view of the study of changes in personality after leucotomy, the type of patient who has been operated on in St. George's Hospital is remarkably accessible, and quite able to behave intelligently and co-operatively throughout the 5 to 6 hours of testing necessitated by this investigation.

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* This paper was read on the 26th July, 1948, at the twelfth International Congress of Psychology.

On the cognitive side the tests chosen were the Wechsler scale of verbal and performance tests, Porteus Mazes, and the proverbs from the Stanford-Binet scale. It was hoped by means of these to tap separately different aspects of intelligent activity: for example, learning as distinct from rote memory, timed as distinct from untimed activity, and social common sense as distinct from a capacity to generalize.

On the temperamental side some objective measures of temperament, such as persistence, speed-accuracy and suggestibility, have been shown as the result of work with neurotics in the last few years by Drs. Eysenck and Himmelweit and myself (1946*a*, 1946*b*, 1948), to differentiate the neurotic from the non-neurotic and the affective or dysthymic syndrome from the hysteric syndrome. These were included, and, in addition, some new measures were designed to estimate temperamental changes which had been hinted at in the literature.

RESULTS.

Only those results are reported in which the probability of such a change occurring is less than ·05, that is, would happen less than once in twenty by chance, using Fisher's "T."

(a) *Intellectual changes.*—Significant loss in special types of ability was found; one of these was verbal ability, as measured by a drop of over seven points in the Wechsler Verbal I.Q. Furthermore, it was found on analysis of the four tests contributing to this score that the loss on the comprehension sub-test was significant when taken alone.

It was noted that on the 10 questions comprising this sub-test the loss was very large on those tapping social attitudes, e.g. behaviour to a friend, keeping of promises, behaviour to prevent an accident. This may therefore not only be a change in intellectual ability, but also in attitude towards one's social environment.

This loss on the verbal scale was of sufficient magnitude to show a significant drop in I.Q. on the whole scale of nearly five points, in spite of the absence of significant drop on the performance tests. This differential change between verbal and performance tests is in line with Greenblatt's (1947) finding of more concrete performance and poorer abstraction ability after leucotomy.

In addition to the Wechsler verbal tests, the capacity to generalize was measured by means of six proverbs, the meaning of which was asked of the patient. After the operation the patients showed less capacity for generalisation, confirming a finding reported by Rylander at the recent International Congress of Physicians.

Porteus Mazes were given in the prescribed manner, except that the time taken over each trial was noted. The post-leucotomy results on these showed a loss of 1·82 years in M.A. In addition to this finding of loss of mental age on the Mazes, the number of double mistakes had increased. This seemed to indicate a decrease in learning ability, a phenomenon which may be associated with the poor results reported by Ritchie Russel in lobectomy performed on children.

Besides the quantitative changes on the Mazes, qualitative differences were also noted. The performance of the patient after leucotomy differs in two respects from his pre-leucotomy behaviour. He makes more mistakes and is significantly faster. Thus, in spite of the decrease in accuracy and the necessity in this test to do the whole Maze again when a mistake is made, there is a decrease in the time taken over all the trials of 2·72 minutes. I shall refer to this finding again. It will suffice to mention here that our results are in line with those reported by Porteus and Peters (1947) and Robinson (1946).

(b) *Neuroticism.*—Now let us turn to the neurotic indicators. "Body sway suggestibility," originally described by Hull (1933), has been shown to be one of the most efficient screening tests for neuroticism in a population containing both the severe neurotics and the milder forms of illness. The mean decrease in sway on this test after leucotomy was 3·06 inches. (It may be of interest to mention in passing that this test correlates highly with hypnotisability).

The work curve of the neurotic has been shown to be jagged and uneven, and to lack a maintenance of improvement when contrasted with the curve of the normal population. The rate of tapping in four quarter-minute periods was measured, and it was found that before leucotomy the mean deviation from the average was significantly greater than after the operation. A similar picture is produced on eight successive trials on the "Track Tracer," a machine designed as a selection test, which was kindly loaned by Prof. Bartlett from his Cambridge laboratory. Prior to the operation the relapses, that is, the losses in speed in the course of the trials, were greater than after the operation. Thus the curve of activity on both these tasks was significantly smoother.

(c) *Diminished introversion.*—Now if we consider the axis at one end of which is the anxious depressed introverted patient, and at the other, the hysteric, extraverted patient, the following measures have been shown to be characteristic of the anxious and depressed group:

(1) Greater persistence in a situation involving an uncomfortable physical position.

(2) A tendency to go for accuracy rather than for speed.

(3) High perseveration scores on motor tests of perseveration.

(4) Intropunitiveness, that is, a tendency towards self-blame rather than blame of the environment.

(5) A preoccupation with the past rather than with the present and the future.

(6) A high level of aspiration, that is, a tendency to aim at a goal beyond their ability, associated with a tendency to underrate their performance when completed.

I shall now report results of tests used to measure the changes on these criteria.

Our post-leucotomy patients showed a loss in persistence on the "leg-test," which has been successfully used to differentiate the syndromes within the neurotic population. An increase in the number of mistaken answers in relation to the number of correct answers was shown on the following Wechsler tests: Arithmetic, Picture-completion, Picture-arrangement. On a test in which words had to be formed out of a given nine-letter word, there was also a greater proportion of mistakes following leucotomy. On the Porteus Mazes, as mentioned previously, the number of mistakes had increased, although the total time taken over all the trials was less by 2·72 minutes. The same picture is presented on the "Track Tracer," where the time of the last try had decreased significantly, although the number of mistakes had increased. Furthermore, the time taken over the arithmetic test and for decision in the rating of pictorial humour had also decreased after leucotomy. Thus we have a distinct tendency for the post-leucotomy patient to go for speed rather than accuracy, in comparison with his pre-leucotomy behaviour. Whether we choose to describe these changes as an increase in impulsiveness, or as a decrease in cautiousness as some authors have done, is a matter of taste.

The pattern of behaviour on the level of aspiration test, for which the "Track Tracer" was used, changes after leucotomy, and moves from that which is typical of the anxious depressed person towards that of the normal individual. The discrepancy between goal and performance was less, and the gap between performance and the judgment had also decreased. The pre-leucotomy records showed that the patients over-estimated what they would do in the future, as well as under-estimating their past performance. After the operation their aspiration of future performance was closer to their real ability, and their estimation of past performance had improved. This indicated a greater reality adjustment on the part of post-leucotomy patients.

A test involving alternating work, which was shown by Cattell (1946) to be most highly saturated with the factor of perseveration, showed reduced P-scores following leucotomy. Judging from this and other measures, there appears to be an increase in flexibility in the performance of motor tasks.

As a measure of the tendency to self-blame, a list of 42 undesirable traits, ascribed to themselves frequently by anxious and depressed patients, was collected. Each of our subjects was asked to state whether he blamed himself for any of these faults. The mean decrease in the number of traits for which the patient blamed himself after the operation was 4·58.

The intensity of self-blame is also considerably less. That is, the diminution in the number of traits on which the patient blamed himself excessively, as opposed to those on which he blamed himself a little or a lot, had a mean of 2·58. The patient's new-found "attitude to the present and future" after leucotomy was shown by their subjective answers to eight standardized questions, based on Israeli's work on attitude to time (1936). After leucotomy 22 per cent. more of the patients were most happy about their future, 43 per cent. more were most unhappy about the past. Correspondingly, 26 per cent. had ceased to find the present their main cause of worry, and 36 per cent had ceased to be most unhappy about the present. It is of interest also that prior to leucotomy 22 per cent. more of the patients had stated that they thought least about the present, and that 33 per cent. more had stated that they were most happy about the past.

We have here, then, a picture of a man who tends to leave his past behind him, lives largely in the present and looks hopefully to the future ; in contrast to his pre-operative state, which tended to be orientated towards the past.

It is of interest that in contrasting the hysteric with the affective group of neurotics, the hysteric showed a relatively low vocabulary score in relation to performance score. Our post-leucotomy population had also lost more on the verbal scale than on the performance scale of the Wechsler: 7·21 as compared with 0·34. This difference in both populations may be partly due to a different temperamental approach to the tasks set, which is penalized on some tests of intelligence and not on others.

(d) *General.*—Among other differences that are of general theoretical and practical interest were the following:—The number of fluctuations on an ambiguous figure in a period of a minute had increased after leucotomy. The significant increase was found on the trial where the patient was asked to try and make the cube change. The patient appears thus to have greater control of the fluctuation. It is suggested by Gordon in an unpublished paper that this control of fluctuation is associated with greater control of imagery in general. This finding may be related also to the greater control of ideo-motor activity shown in the results on the suggestibility test.

Concentration was measured by the ability to remember groups of figures from a series which was interrupted at irregular intervals. After leucotomy there was a slight decrease on this concentration test, but it did not reach the level of significance. On the other hand, a test of "distractibility" was devised, on which the same task was performed, but to the accompaniment of the ringing of a vibrant telephone bell, and on this task there was an improvement of performance after the operation.

It would appear that post-operatively the patient is less bothered by extraneous stimuli. I did wonder whether this finding was related to the decrease in sensitivity to pain described by Fulton and others, as after carefully plugging my ears I had to brace myself to tolerate the intense unpleasantness of giving this test.

Although individually not reaching the level of significance, on two different approaches, time for the patient appeared to go more quickly after leucotomy. That is, a period of 60 seconds passed more quickly and the time taken over the first trial on the "Track Tracer" was underrated. This is mentioned, as it may be related to autonomic changes noted, and to a recent finding that time appears to go more quickly if internal temperature is raised.

The patients' attitudes to their condition also changed after leucotomy. Prior to the operation 75 per cent. thought they were ill, and 25 per cent. thought they would never get better. Afterwards 25 per cent. thought they were ill, but all believed that they would get better. Apart from deciding that they were no longer ill, they also ceased to saddle themselves with a number of unpleasant traits. In addition to a decrease in criticism of their own character a seemingly decreased critical attitude towards the use of language was shown. One of the interesting findings by the wayside was that frequently, after leucotomy, and never before, definitions and answers were produced in which common words were misused, or new words formed. In each case the experimenter pretended not to have heard correctly and repeated questioningly the phrase used. The phrase was then repeated by the patient verbatim. Examples: (Woman, verbal I.Q. 109·5.) A "hero" is a man who has "committed skill." Affliction is an "aside, affectation, people pretending what they are not." (Man, verbal I.Q. 120.) A "fable" is "a far-reaching tale"; on questioning, stated he meant "that it reached far back into history." Dilatory is doing things "in a ship-shop manner." Espionage is "spy-ism" and so on. This seems to suggest a loss in the finer distinctions of language.

CONCLUSIONS.

Instead of giving a detailed summary of these findings, I will try to build up a picture of the patient as we have found him after leucotomy. Here is a person in whom neuroticism is less marked, especially as shown by a decrease in suggestibility, a smoother work curve and his attitude towards himself. There is marked decrease in the traits characterizing the anxious, depressive, introverted type. He goes more for speed and less for accuracy. He is less persistent in a situation requiring endurance. He blames himself less for the fewer undesirable traits he still ascribes to himself, now regarding these as inevitable. He lives less in the past, and more in the present and the future. He has lower motor perseveration scores, and the goal he sets himself and his judgment of his performance are closer to reality. He has dropped on verbal intelligence test scores, and on tests where impulsiveness is penalized. Learning is more difficult, but routine tasks once learnt are easier. He is also somewhat less distractible.

The personal effectiveness of a patient has changed after leucotomy as a result of all these changes in the conative, affective and cognitive spheres, and there seems little doubt that other changes will come to light with further research.

It is unjustifiable for us to consider apparent losses in, for example, verbal ability without noticing apparent gains, such as that less variation in performance is shown, that marks are gained for speed and so on.

This is a preliminary report following the first post-leucotomy re-tests, but it would seem to justify intensive further research along these lines. It is hoped to present a second report as soon as the 8-monthly retests are completed. An attempt is also being made to match each patient with another of similar personality, age, intelligence and severity of illness, who is not undergoing prefrontal leucotomy. We have had great difficulty in finding such patients, but the search continues. The general behaviour, however, of the neurotic population on re-testing is known, and no changes, for example, have been found on repeated applications of suggestibility, persistence and level of aspiration tests. On the intelligence tests used, where a change has been found on re-testing, it is, of course, an improvement, and not a loss such as these patients have shown.

These are the results on a group of severe neurotic rather than psychoti cases. The most convincing clinical results, according to some writers, ar obtained from leucotomy performed on psycho-neurotics. From the point o view of this investigation, the condition of the patient enabled tests to b carried out to which it would have been very difficult to subject psychotics Psychotics may, in fact, show the same or similar changes, but they have a yet not been demonstrated.

Critical Ratios of Certain Differences Found after Leucotomy.

Intellectual Measures.

Loss on Wechsler Verbal Scale I.Q.	4·81
,, ,, Performance Scale I.Q.	0·24
,, ,, Full Scale I.Q.	4·02
,, ,, Comprehension Sub-test	4·42
,, Porteus Mazes I.Q.	3·14

Non-Intellectual Measures.

Decrease in body sway suggestibility	4·81
,, in variation from average in tempo of tapping	2·34
,, in excessive self-blame	3·53
,, in general self-blame	2·53
,, in physical persistence (Leg Test)	2·82
Increase in number of double mistakes in Mazes Test	2·47
,, in motor perseveration scores	1·90
Decrease in time taken over all Mazes	2·47
,, in time taken over final effort on Track Tracer	2·81
Increase in fluctuations of ambiguous figure (with effort)	2·24

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Bibliography.

Cattell, R. B. (1946), *Description and Measurement of Personality.* Yonkers-on-Hudson, New York.

Eysenck, H. J., *et al.* (1946), *Dimensions of Personality.* London: Kegan Paul.

Greenblatt, M., Arnot, R. E., Poppen, J. L. V., and Chapman, W. P. (1947), "Report on Lobotomy Studies at the Boston Psychopathic Hospital, 1947," *Amer. J. Psychiat.*, **104**, 6, 361.

Himmelweit, H. T., Desai, M., and Petrie, A. (1946), "An Experimental Investigation of Neuroticism," *J. Personality*, **15**, No. 2, December.

Hull, C. L. (1933), *Hypnosis and Suggestibility: An Experimental Approach.* D. Appleton-Century & Co., New York.

Israeli, N. (1936), *Abnormal Personality and Time.* New York: Science Press Printing Co.

McKissock, W., and Fleming, G. W. T. H. (1943), "Prefrontal Leucotomy," *Lancet*, **1**, 361.

Petrie, A. (1948), "Repression and Suggestibility as Related to Neurotic Syndrome," *J. Personality*, **16**, 445-458.

Porteus, S. D. (1933), *The Maze Test and Mental Differences.* Vineland, N.J.: Smith.

Idem and Peters, H. N. (1947), Maze Test Validation and Psycho-Surgery. *Gen. Psychol. Monographs*, **36**, 3–86.

Robinson, M. F. (1946), "What Price Lobotomy?" *J. Abn. and Soc. Psychol.*, **41**, 421-36.

Terman, M., and Merril, M. A. (1937), *Measuring Intelligence: A Guide to the Administration of the New Revised Stanford-Binet Tests of Intelligence.* Boston: Houghton & Mifflin.

Wechsler, D. (1941), *The Measurement of Adult Intelligence.* Baltimore: Williams & Wilkins.

THE DUAL PERSONALITY OF PHILIP HESELTINE.

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Mr. Cecil Gray, in his excellent study, *Peter Warlock*,* holds the view that Philip Heseltine's character only becomes understandable if he is regarded as an example of dual personality. Gray gives very clearly and, in my opinion, conclusively the evidence on which he bases this belief. The only question that is left unanswered is the clinical nature of the duality.

That it was a schizophrenic splitting can, I think, be ruled out altogether. Heseltine showed no schizoid features. I do not think that in his own mind Gray was troubling very much about the different types of " split mind." As far as he went he saw it as something like Stevenson's fable of Jekyll and Hyde, but not so crude and simple, for, as he says, " there was much in Peter Warlock that was admirable, and much in Philip Heseltine that was not so admirable." This type of duality is hysterical dissociation, such as has been described by Hyslop, Morton Prince, Janet and so on. This is the popular picture of double personality, and I think it as such that Gray conceived him.

However, there is a third group in which a dual nature shows itself, and that is cyclothymia. It is the thesis of this short paper that the composer showed well-marked cycloid traits, and in the sequel it is proposed to bring forward evidence that Peter Warlock displayed features of the manic type, Philip Heseltine characteristics of melancholia.

To suggest that possibly our greatest composer of songs since the seventeenth century showed character traits closely allied to those of manic-depressive psychosis may seem to some an outrage. However, it should be remembered that the inheritance of this psychosis shows irregular dominance. The geneticists say that the dominance of a gene is biologically evidence that it is of survival value. If conditions change and new adaptation is required, dominant genes become recessive, and vice versa. It is therefore suggested that since cyclothymia is dominant genetically, it is because the phenotype makes a useful contribution to society. There is little difficulty in finding this biological usefulness in the drive of the hypomanic. It is true that some of us don't like it; it makes us conscious of our own shortcomings when we see someone else rushing about and getting things done. It is some satisfaction then to console ourselves by attaching a scientific label. Of course one can have too much of a good thing, and acute mania or melancholic stupor are the price paid. It is probable that many modifying genes take a part in determining whether a certain individual will be a valuable social asset or a psychotic.

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* I quote largely from this book, to which I am indebted for most of my information.

According to the Freudians mania is a kind of saturnalia following a period of depression, grief or mourning. This is certainly true in some cases, but there are many other types. A common one is the man whose normal tempo is hypomanic. He is successful at business, leads an active social existence and a full life generally, then perhaps in the fifties something happens—he retires, his wife dies, he has an illness or accident. There is some change in his routine, he is unable to cope with the new situation and develops a reactive depression. Of course by no means all hypomanics develop severe depressions, nor are all depressives over-active previous to their illness.

But there are two other types of people who, in my opinion, show evidence of the cycloid constitution. There is the gregarious type of man, who is able to be a friend to everyone. He is popular at the club, at a dance, at a party, at the golf-club. He is also often a good leader of men in the forces or the factory, because the men like him. He has an easy manner, he is a good raconteur and can turn on charm like a tap. He can also turn it off again. If he is not the centre of attraction, if things have not been arranged as he wished, or he feels he has been slighted, he can be sulky and moody and most damaging to the well-being of the social group. These black moods are most often experienced only by those living in his own domestic circle. In such a man it is hard to say to what extent these moods are engendered by external experiences or constitutional factors.

Lastly there is a type which, I think, bears some relation to Philip Heseltine. Such a man is diffident and self-depreciatory; he is often depressed, and when he is alone with you will tell you he is a failure and useless at his job. In company he is quite a different man. He has not the easy natural charm of the previous type, but you are surprised to find how many social assets he has. He talks well, is quick witted and has a sense of humour. He may overplay the part and become too exuberant. You realize he is popular and you learn he is a success at his job. You may or may not learn that this veneer or protective covering has been arduously cultivated. Even if you do realise this point, I suggest that there must have been something there to cultivate.

It would not surprise me to be told that the above personality type had no relation to cyclothymia. However, if such a personality is exaggerated to a considerable degree, I think then it will be found to have a close relation to this clinical entity. In my opinion Philip Heseltine was such a person, and I now propose to bring forward the evidence.

The only relevant facts in his early life are that he was an only child, his father died when he was two, and at some period afterwards his mother married again. He was educated at Eton and was precocious intellectually, but Gray regards his psychological development as slow. This is based on the fact that at the age of 16 he expressed conventional views on religion and politics.

The most important experience during his youth was his introduction to Delius at the age of 16. A friendship grew up between the famous composer and the young man. There was a large correspondence, which has fortunately been preserved. It is the letters Heseltine wrote to Delius that provide most of the information on the early manhood of Heseltine.

Gray rightly points out that one is only seeing one side of his personality in such letters, his inner life and his blacker moods. We learn first that he has an intense admiration for the music of Delius, also for the man, whom he regards as a father-imago. He is already devoted to music, but is very despondent about his ability to do anything worth while, and at best hopes to be a music critic.

In one letter he gives a very illuminating and instructive account of himself. It is clear that he has taken himself to task, and is very depressed and dissatisfied with the result. He feels that he had always taken things for granted, had not thought for himself, and that now he is years behind other people and cannot catch up. As he is at present he regards himself as " an absolutely useless specimen—only fit, as I am, for the lethal chamber." However, against this feeling of self-depreciation is passionate hope and expectation. This keeps him going, even if it is only an illusion. Then he complains of his morbid self-consciousness and habit of introspection. He feels he is a spectator, detached from real life. Undoubtedly it is this which he means when he complains that he is being constantly dragged back. Then still more illuminating—" Lately I have tried passionately to plunge into life, and live myself, forgetfully if possible of this horrible aloofness." He thinks he is just beginning to succeed a little and that he is becoming harder and a little stronger. He explains how he had always been alone, clung to the atmosphere of home and hated school life. Now he can no longer endure his home (his mother has married again), and is more lonely there than anywhere else. He goes on to complain that he is morbidly nervous—" even down to a physical nervous stricture "— which handicaps him socially. His final dictum is—and this is the most interesting point of all—that he would sacrifice all social success if he could return to his dreams and from them create realities. But having lost faith in his creative ability, he is determined to live.

In this remarkable psychological document, a despondent, morbidly self-conscious and self-critical young man writes to his father-imago saying he will throw away his dreams to live life to the full. A melancholic decides to turn manic by a conscious decision. More extraordinary still he succeeds in the latter, and in so doing, to some extent realizes his dreams.

Robert Nichols takes up the story during the short period from 1913 to 1914 that Heseltine was at Oxford. In this portrait of a young artist we gain insight into various aspects of his character. He is described as a man of great enthusiasm for life, music and books, his knowledge is wide and many-sided, but he is moody, passing abruptly from dismalness to hilarity, and then to weariness, irritability, and finally dejection and exhaustion. Nichols, an ardent Heseltine protagonist, grudgingly admits that there is some truth in D. H. Lawrence's view that he was not a well-synthesized personality, at least when at Oxford. On the other hand, he thinks that Lawrence totally misjudged Heseltine when he describes him as a " bit backboneless." In Nichols's opinion there was in Heseltine " a fundamental inner gentleness " which Lawrence inaccurately mistakes for backbonelessness.

Many other traits are already present to be enhanced later in his life. These include his bellicosity in argument, his delight in eccentricity and practical jokes, and lastly his facility for "rigmarole, nonsense verses and limericks, Priapian and other."

Up to the present stage I would say that nothing has been produced to suggest that Heseltine was in any way an abnormal, though he may have been a superior type of undergraduate. I say this with one reservation. He was intelligent, enthusiastic, and subject to moods of exuberance and despondency and self-criticism, but many young men are. I can see nothing to indicate that he would not have become a worthy civil servant or perfectly adequate music critic. His passion for music is not incompatible with this. The one really unusual thing is that Delius should have thought so much of him that he kept all his letters.

The next phase is the early war period. He became a frustrated musical critic, and divided his time between London and Cornwall. It was the period of friendship with Lawrence, and ended with a rupture and Lawrence's parody of Heseltine's character in one of his novels. I think the war had a big psychological effect on him, and there are many references to it in his letters to Delius. He himself was exempt from war service for physical reasons, but his attitude was that of the conscientious objector.

Though much of the time he moved in a small circle with similar opinions, there is evidence in the letters that he felt keenly the hostile attitude of the crowd. He complains to Delius of his isolation, and that unless "one becomes a mere hypocrite, one is cut off, in one's sympathies and mental outlook, from at least nine-tenths of one's fellow beings." And again he feels keenly "the cheap sneers and dismal attempts at wit of the vulgar, blatant and exasperating Jingoes." He admires Delius for his complete detachment from the crowd, a thing Heseltine could never completely achieve. A part of him required social life and admiration. It would seem that he was good in attack, and virulent with his tongue and pen, but, at that time, weak in defence. There is no doubt he was very sensitive to criticism, and was easily hurt. It was only later that he provided himself with a protective covering. He was not the sort of man to keep his views to himself; I have no doubt he gave as good as he got defending his point of view, but what he got hurt severely.

A letter to Delius in 1915 suggests a melancholic episode, which, he states, had been at its worst two months before, and one gathers is now beginning to lift, because he speaks of "fitful and transitory intervals." Also he is able to write to Delius, which he could not do before. He is depressed and pessimistic; he cannot think; he feels in a confused and trancelike state. His head "feels as though it were filled with a smoky vapour." "Words simply will not come out of my mouth." He is no longer able to feel the beauty of nature.

The letter is broken off abruptly and is only completed a week later. It would appear that the previous phase was followed abruptly by one of wild exuberance, during which he rode "a motor bicycle through the village streets at midnight at a speed of about 60 miles an hour, stark naked." Gray holds the view that such melancholy letters were an expression of the "morning after" feeling. Up to a point I would say this was true. Heseltine was coming out of the more acute phase of his melancholia and was probably forcing himself with the aid of alcohol, hence such wild madcap behaviour. The reaction to this in a fundamental melancholic state could well be a still more intense fit of the blues. The letter to Delius of 22.viii.15 reads to me as if something much more serious was wrong than alcoholic remorse.

It is unnecessary to go into the details of the next few years. It was a period of great endeavour, many projects and but little achievement. He produced much poetry, practically all of which he destroyed, also a very little music, and Gray admits that he did not think that he would ever make a composer at that time. Among the many projects, few of which got very far and none succeeded, two may be mentioned—the publication of a new musical journal and a West End production of neglected operatic master works. Up to this point, then, Heseltine had been a failure.

However, a change came in 1918, when a group of songs previously rejected under the name of the failure Philip Heseltine were accepted as the work of Peter Warlock. It was in this year also that he grew a beard for the first time. Of the beard Gray says: "Its adoption is extraordinarily revealing and, indeed, of crucial importance for an understanding of the man; it is, in fact, the first decisive step towards the elaborate mask, which he was ultimately to adopt permanently as a defence against a hostile world." Over the next three years, a period of rich musical production, the beard came off and on several times. By 1921 the transformation was complete; he was never again without his beard, and he had become "the lusty, roystering, swashbuckling, drinking, wenching Peter Warlock of popular legend."

It should be noted that, just as Philip Heseltine presented certain characteristics later incorporated in the Peter Warlock façade, so the character Philip Heseltine was never completely lost in Peter Warlock; he was merely submerged. From time to time to his intimate friends the mask was off, but these intervals became increasingly rare.

It is now proposed to contrast the two personality types, in an attempt to show their relation to mania and melancholia.

Manner and behaviour.—Heseltine, as we have seen, was a sensitive, shy dreamer with a rather weak chin. He did not mix easily, was nervous in company and had only a few intimate friends. He was uniformly unsuccessful with women, was fond of children, had a taste for sweet liquors and for quite a time was a vegetarian.

Warlock shook off his old friends, and became the centre of a vast horde of acquaintances and boon companions. At the Café Royal and at the various inns he frequented he must have been a striking figure, with his goat-like beard, the mischievous twinkle in his eye and his sardonic smile. His wit was nimble, both by word and with the pen. In the mood there was a great outflow of bawdy talk and blasphemy, with rhyme and play on words. He was a great swiller of beer, had a taste for steak tartare, and affected to be a drunkard and a drug-addict, to dislike children and to have a contempt for women. With women he was masterful, polygamous and uniformly successful. He had a penchant for impromptu acrobatic dancing, a macabre *pas seul* in unlikely places, such as Piccadilly Circus, Queen's Hall or a railway station.

It is very difficult to provide evidence of the wild and sustained exuberance that, I believe, was the Peter Warlock of the latter years, especially the Eynsford period. Gray tells us what he was like, and describes incidents. But they are only episodes and lack continuity. Foss gives a good epitome of his character seen from both sides: "He had the delicacy of the hothouse plant and the ebullience of the willow-herb that grows on ruined bomb-sites. Humour in plenty, shyness of an odd kind, a roaring laugh that would give way to a fit of solitude and melancholy—that was Warlock, the man who exquisitely poised the psychologist's requirements of both introvert and extravert." However, to see Warlock in action, it is necessary to turn from biography and criticism to fiction. Aldous Huxley knew Warlock well in the 'twenties, and in *Antic Hay*, at the "Bearded Cossack," he provides a vivid and lifelike picture of the composer as he appeared to his boon companions. This portrait is uncomplicated by any attempt to describe the man behind the mask. Gray tells us that Warlock was delighted with the character, and that he, Gray, was a witness to one of the scenes described.

The "Bearded Cossack" only makes a few brief entrances in the course of the story. Once at a Soho restaurant, at a coffee stall, in a night club and in his own flat, but while he holds the stage a rapid tempo is sustained. His companions include an artist and a literary critic, the main butts for his wit, an ex-schoolmaster, a physiologist and an odd assortment of women. The Cossack is a young man with "a blond fan-shape beard," bright blue eyes, who smiles "equivocally and disquietingly as though his mind were full of some nameless and fantastic malice." His flow of talk is punctuated by peals of cracked and diabolic laughter, while, on stage, he is in a state of continuous activity. He sings, dances, rhymes, puns, and plays on words. He is free with his gestures and gives pantomimic performances. Whatever line the conversation takes by some association he turns it usually to blasphemy or bawdy talk. His verbal wit is directed against the Church, conventional moral values and the conventional aesthetic view-point. Reading these striking passages in Huxley there can be no doubt that a hypomanic is being described. Also it is as near as it is possible to get to a presentation of Heseltine when the Warlock was on him.

It is appropriate to cite here a curious incident described in the foreword by Augustus John: "While in the midst of a brilliant discussion which, though a little over the heads of the audience (Norfolk yokels), was listened to with fascinated attention, Philip suddenly collapsed as if struck down by some mysterious seizure." All attempts to arouse him failed and he was left where he was for the night. The next morning he was quite restored. Augustus John goes on: "I found that this behaviour was characteristic of Philip, whose intellectual activity never languished or slowed down, but at a given moment would just stop dead, blown out, as it were, like a candle." No one can know what was going on in Warlock's head at such times; perhaps nothing; if so it may have been alcoholic stupor. However, I put forward the suggestion that it was manic stupor.

Stream of thought.—Heseltine found creative work difficult. He composed little and slowly, and his style was laboured, hesitant and uneasy. He found difficulty in expression, both in speech and writing. He complained of poverty of thought, mental blankness, and that ideas would not come.

Peter Warlock's compositions were neat, easy and fluent. His productivity was large, considering the short period of his existence, 1921–23, 1924–30. There is evidence of a depressive phase in 1923–24 and again in 1930. There was also marked press of ideas, which expressed itself in verbosity and in writing. He was brilliant at producing limericks, most of which could not be printed, because they were either too pornographic or too libellous, though one did find its way into the *Week-end Book*. He also had a taste for nonsense rhymes and rigmarole. He delighted in play on words, portmanteau words, neologisms and double meanings. Gray quotes as a good example, " The Felis Catus Castiengis of Carrollingian Legend. The association being the Cheshire Cat and castrated cat, Charlemagne and Lewis Carroll."

Another example is to be found in Warlock's anthology of gorgeous drunkards through the ages—" Merry-go-down." Here he provides two short pieces under the signature, " Rab Noolas." One is a limerick, the other a nonsense rhyme, which I attempt to interpret. It reads as follows :

A DRUNKEN SONG IN THE SAURIAN MODE.

Two Mogs which, in the abstract, pull
A Puffin and a Pentacle,
    Nor synthesize too soon,
Can hocket Crisp and Cosmic Things,
What time th' untutor'd Unko sings
    Her enharmonic Rune.

But ALLIGATORS, which, to One
Accustomed to the Bathly Bun,
    Seem to Recant and Sneer,
Connive, and so coagulate
The polyphonic postulate
    At £50 a year.

One stamping Secretary-bird
Might solve the Sempiternal Surd :
    BUT, ON THE OTHER HAND,
No judge may juggle Stibial Stars
For fubsy Punks in Public Bars
    Where Cranes are Contraband.

RAB NOOLAS.

(Grisly contingencies, interspersed (however) with pleasing propositions.)

Manifest content.—We are in a Carrollingian world, where Punks and a judge jostle cheek by jowl with a Puffin, Alligators, a Secretary-bird and Cranes. We also meet more fabulous creatures, such as two Mogs and an Unko. In the earlier stanzas we are in the laboratory of the alchemists. That a magical rite is in progress is clear from the repeated references to the terminology of alchemy and astrology. For example, the rune, the pentacle, coagulate, cosmic things, stibial stars. It is learnt that these activities are an attempt to solve the sempiternal surd. In the last stanza, as in a dream, the scene suddenly changes to a Public Bar. Since we are dealing with alchemy, I think that, even at the manifest level, it can be stated that the leading motive is the turning of base metal into gold.

Latent meaning.—The title indicates that the subject matter is music and that it also deals with allegations. Knowing Warlock's views about music critics it is surmised that they are being attacked.

We are in a concert hall. An untaught and unknown singer is chanting a dirge extremely badly. However, two musical hack writers, who are always prepared to put in a " puff " for a consideration, and anyhow are anxious to use their pens, are prepared to cheat you by saying the performance is heavenly. But to the surprise of the poet, who is used to the sugar-coating of most musical critics, there are several hostile critics who sneer at the bad performance. However, even they, for the paltry sum of £50 a year, are induced to fall into line, so consolidating the good notices of this bad singer.

The poet then bemoans the fact that there is not even one virulent and honest critic who could put a stop to the eternally irrational principle of praising bad music as good.* But in a public bar it is consoling to know that no one can deceive you into believing that an amateur is a corpulent professional. This is because in a bar you are not allowed to rise above your sphere by means of outside agents. The only form of elevation is spiritual.

To digress for a moment this interpretation does throw light on a matter that seems to have puzzled Gray. Talking of Heseltine's proneness to quarrels, he says : " For the rest his feuds were mainly with musicians and generally with music critics. I do not think there was a single one of eminence who was not at one time or other the object of his aversion and the recipient of his insults and abuse, generally in writing. To one in particular he was in the habit of sending, from whatever part of the country he was in, at regular intervals, pairs of bellows, the precise significance of which must necessarily remain veiled in obscurity." False alchemists were called puffers, because of the fury and noise with which they used the bellows on their furnace, when transmuting base metals into gold. If the above interpretation is correct the nature of Heseltine's private joke is discovered.

Here is a last example of these far-fetched associations. On the advice of a music critic Yeats rejected Heseltine's setting of " The Curlew." An acrimonious correspondence followed, terminated by the composer in characteristic fashion : the despatch of a picture postcard of the Adjutant Stork. Gray suggests that the implication is " that his antagonist had attained to such a pitch of absurdity that an adequate reply was beyond the expressive range of mere words and could only be suggested by the contemplation of the strangest freaks of Nature." There is still the question of the choice, among so many strange birds, of the Adjutant. I suggest that it is because of this bird's voracious appetite, no carrion, offal or putrescent matter being distasteful to it.

Mood.—In Heseltine the prevailing mood was one of despondency, with phases of acute despair, when he craved for oblivion. It is to be presumed that it was in some such mood that he put an end to his life.

In Warlock the prevailing affect was one of elation and well-being, punctuated by extreme bellicosity and virulent hatred. These latter feelings were aroused by the philistines, certain academic musicians, music critics, publishers, and others, whose views were hostile to his own or whom he believed to be insincere or mercenary.

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* The Secretary Bird is officially protected because of the readiness with which it kills venomous snakes and other noxious animals by means of its powerful feet.

Content of thought.—Possibly the most fundamental sentiment in Heseltine was a love of nature in all its aspects. It is a constantly recurring theme in his letters, and in one of his depressed letters to Delius he writes: "I watched the sun go down behind the hills, flooding the broad valley with a golden light that would in former days have made my whole being vibrate with its beauty—but I wait in vain for that old ecstatic feeling. The colour and intensity of these pictures have become things external to me—they are no longer reflected in me, I can no longer merge myself in the *Stimmung* of Nature around me. I can only gaze wistfully, from afar, at her beauteous pageantry. I can no longer take part in it, and so am debarred from the greatest—perhaps the only—source of joy, solace, and inspiration that life offers me." Delius translated the feelings Heseltine felt for nature into sound. It is a beautiful, if melancholy, dream world, poems of the sea-shore, of mountains, of lazy rivers at night, of summer gardens, of the spring and of the early norning. The true Heseltine music also to some extent reflects this mood, though there is more yearning and more despair. "The Curlew," a setting of a poem by Yeats, is a typical Nirvana song, with its haunting refrain, "The boughs have withered because I have told them my dreams." Another is Beddoes' "Sorrows Lullaby," where the longing is for sleep and oblivion, and still better, death. In the three macabre dirges by Webster the mood is the same, release in death. Another important influence is the music and poetry of the sixteenth century and earlier. His erudition was considerable concerning Elizabethan music and poetry. He transcribed and arranged a vast amount of music of the period, and his volume, *The English Ayre*, is generally considered a scholarly performance, as also is the editing of *Giles Earle His Booke*. Besides the music of the sixteenth century, Heseltine also had a great affection for folksongs and carols.

Intermediate between Heseltine and Warlock there is a whole group of Nirvana songs. In all of them the inspiration would seem to be Heseltine, the manner usually that of Warlock. They range from Decker's "Lullaby" and "Rest Sweet Nymph," to such tragic songs as "The Fox" and "Ha'nacker Mill," which are almost pure Heseltine. Intermediate is the nostalgic "My Own Country," also "Mourn No More," "Sleep," and "Night." In the last the motive is sleep and oblivion.

The next group is the carols, of which there are about a dozen. Here, again, the inspiration is Heseltine, if the mode is mainly Warlock. All that carols stand for centres around one subject—adoration of the mother-child relationship. If one cannot find peace in sleep or death, then a man can retreat in fantasy to the infantile stage, when the mother guarded him from a hard, cruel world. A time also, in this case, before the mother betrayed him. Possibly this same motive explains the dichotomy in his love-life. The good woman was sexually taboo because, she was for him the mother. Only a harlot, therefore, was outside the taboo. Gray tells us that his intimate life was "in a kind of rondo form, in which one persistently recurring theme alternated with continually new subjects—AB, AC, AD, and so on." D. H.

Lawrence clearly appreciated this when he wrote of Heseltine in his letters: "His affection for M— is a desire for the light because he is in the dark. If he were in the light he would want the dark. He wants M— for companionship, not for the blood connection, the dark, sensuous relation. With P – he has this second dark relation but not the first. Perhaps he is very split, and would always have the two things separate. For these people I really believe in two wives."

In *Women in Love*, as Gray notes, he puts it more crudely in his parody of Heseltine: "he wants a pure lily, with a baby-face, on the one hand, and on the other he must have the Pussum, just to defile himself with her. She is the harlot, the actual harlot of adultery to him. And he's got a craving to throw himself into the filth of her. Then he gets up and calls on the name of the lily of purity, the baby-faced girl, and so enjoys himself all round. It's the old story, action and reaction, and nothing between."

As is to be expected in a lyrical song writer, a large number of the songs are concerned with the motive of love. They deal with the passion in all its moods from wistful melancholy to the bucolic and racy. There are folk songs, Elizabethan songs, and a few settings of modern poets. They are all Warlock in style, and a large number in mood. If one wishes to escape from a hard world it is pleasing to dream of fair women, especially if one can set the words of the best poet to great music. It is Heseltine again who calls the tune; Warlock is the executant.

Lastly there is a fairly large group of typically Warlockian drinking songs, rather over a dozen of them. Incidentally Warlock was always in quest of the perfect beer, "a kind of ambrosia or nectar of the Gods, but made out of pure hops and nothing else." Many times he thought his quest successful, "only to discover it had a larger percentage of arsenic or sulphuric acid than any other." Alcohol also brings relief from sufferings and sometimes oblivion; unfortunately its action is of short duration. Perhaps the perfect beer would create that Nirvana for which Heseltine's soul craved, the Nirvana which eluded him wherever he sought it.

So far, then, wherever we have looked, all the inspiration is Heseltine's. Even the drinking songs and the poem "in the saurian mode" are found to be inspired by feelings and thoughts typical of Heseltine. The fact is that Warlock had no inner content; he merely used Heseltine's dreams and musings in a way that was acceptable to the public. Such thoughts as he had or affected were merely the obverse of Heseltine's deepest convictions. Warlock scorned softness, gentleness, sentimentality and the "pure" woman. I think Heseltine had a deeply religious nature. Not orthodox it is true, possibly a pantheistic nature worship. Warlock despised serious convictions, and delighted in blasphemy. He also sneered at the music Heseltine liked most, that of Delius.

Clearly Heseltine had found that "The boughs have withered, because I have told them my dreams." Warlock told none of his dreams, for he had none to tell. What he did try to do was to take his revenge on society by ridiculing conventional standards and notions, especially the more smug upholders of such values.

It is only fair to say that some do not agree with Gray's portrait of Peter

Warlock. Epstein, for instance, regards Gray's book as "one-sided and idealistic." He found Heseltine a "restless and discontented character. . . . His mentality was, I thought, warped by a very crude and childish streak, and practical jokes of a childish sort satisfied him." Against this it has to be remembered that in about 1921 Epstein and Warlock, who had been friends, parted after a violent quarrel. Gray does not state the cause of hostilities. Perhaps it was about Delius, whom Epstein describes as argumentative, cranky, bad tempered and with little sense of humour, or perhaps Epstein was the recipient of one of Warlock's little practical jokes.

To the psychiatrist it is a matter of indifference if the pantomine was well or badly done; it certainly annoyed a number and delighted others. To the psychiatrist the interest lies in the fact that a fundamentally melancholic individual could consciously adopt a manic façade, that this façade should become a permanent cloak, finally extinguishing the original personality.

Finally, I would like to quote Bruce Blunt's poem, "The Fox," one of the last poems which Warlock set to music. It might well be his epitaph. Foss, I do not know with how much insight, rightly calls it the Warlock counterpart of Schubert's *Doppellgänger*.

At "The Fox Inn," the tattered ears,
The fox's grin, mock the dead years.

High on the wall above the cask
Laughs at you all the fox's mask.

The horn is still, the huntsmen gone;
After the kill *the* fox lives on.

Death's date is there in faded gold;
His eyes outstare the dead of old.

Beneath this roof his eyes mistrust
The crumbled hoof, the hounds of dust.

You will not call, I shall not stir
When the fangs fall from that brown fur.

Some may think that by now "the fangs have fallen." If so I refer them to Sitwell's autobiography "The Scarlet Tree," p. 279. The conversation between author and composer can be given a Warlockian twist, if it is remembered that mosaic is also ormolu.

REFERENCES.

Peter Warlock, by CECIL GRAY. Jonathan Cape, 1934.
Frederick Delius, by PHILIP HESELTINE. John Lane, 1923.
The English Ayre, by PHILIP HESELTINE. Oxford University Press, 1926.
Merry Go Down, by RAB NOOLAS (PHILIP HESELTINE), and decorated by Hal Collins. Mandrake Press, 1929.
Giles Earle His Booke, edited, with preface and notes, by PHILIP HESELTINE. Houghton Publishing Company, 1932.
"Peter Warlock" (Philip Heseltine), by HUBERT FOSS in Bacharach's *British Music of Our Time*. Pelican Books, 1946.
Antic Hay, by ALDOUS HUXLEY. Chatto & Windus, 1923.
Women in Love, by D. H. LAWRENCE. Martin Secker, 1921.
Witchcraft, Magic and Alchemy, by GRILLOT DE GRIVY. George G. Harrap & Co., Ltd., 1932.

A RORSCHACH STUDY IN FOLIE À DEUX OF MOTHER AND SON.

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Communicated mental illness or " folie à deux " in which the parent appears to have influenced the child is a frequently found disturbance in general practice and Child Guidance Clinics. The child is especially disposed to such a disturbance because he lives during the first years of his life in almost complete identification with the parents' psyche. In a healthy environment his growing consciousness will gradually resolve this identity, and thereby develop his ego and individuality. If, however, one or both parents suffer from mental illness this process is liable to be disturbed, and the child will remain fixated to the disordered psyche of the parent.

The recognition of " folie à deux " is of considerable importance, as there is a special treatment of the disorder and the prognosis often depends on an early diagnosis. In addition to clinical observation the performance of a personality test can be of great assistance in assessing the personalities of the partners. The Rorschach test, more than any other personality test, furnishes objective findings which can check and supplement the subjective impressions of clinical observation. It gives a refined insight into the personality structure, and yields unique starting-points for analytical exploration.

This study will describe the use of the Rorschach method in the psychiatric assessment of parent and child in a case of " folie à deux." A special aim is to demonstrate thereby that the Rorschach method is a valuable help in genetic studies of the personalities of several members of one family.

History.

Allen, a boy of 9 years and 2 months, was referred to a Child Guidance Clinic in April, 1948, because during the past few months he had been inclined to retire within himself and to cry when spoken to.

The maternal grandmother died of cardiac disease when the mother was 5 years old, and the maternal grandfather died two weeks afterwards from a " broken heart." The mother was sent to an orphanage, where she spent ten extremely unhappy years. There she had many day-dreams of having a mother and father and of living with them in a big house, where they invited poor children. She was depressed throughout these years and suffered from rheumatic fever twice during this time. She married at 25. Owing to valvular disease of the heart she had to stop all sports activities and she became depressed again.

Allen was the second of four children. He was a "model baby," and especially attached to his mother. After starting school he became irritable, and at 7 he began sleep-walking. This meant disturbed nights for the mother, and increased her nervousness and depression. Finally Allen became very worried about school, refused food and retired within himself. He began to cry at the slightest provocation and clung to his mother more than ever.

ON EXAMINATION.

The mother was very depressed and slightly retarded. She confessed that she no longer cared for life.

Allen was depressed too, and had some difficulty in thinking. He looked anxious, and sometimes as if he were in a trance. On the Terman-Merrill test he had an I.Q. of at least 90.

He produced a painting, showing a big mother dog leading a procession of two baby dogs. It looked like an unconscious and almost humorous allusion to his state of dependence on his mother.

THE RORSCHACH TEST.

A Rorschach test was performed with Allen and his mother. It followed the technique as described by B. Klopfer and D. Kelly.

Allen showed the following record :

		Performance and inquiry.	Scoring.			
I	2 mins.	Refusal		—		
II	2 secs.	(1) Two bears. Their heads and ears. Here are their legs	VX*	F+	A	P
III	2 mins.	Refusal		—		
IV	1 sec.	(1) A tree because of the trunk. Here could be leaves and branches. An oak tree	DW	F	Pl	
V	2 secs.	(1) A butterfly	W	F	A	P
VI	2 mins.	Refusal		—		
VII	3 secs.	(1) Two rabbits. Their heads, ears, tails and bodies	VX	F+	A	P
		(2) A butterfly with wings	D	F	A	
VIII	6 secs.	(1) A tree. In autumn (allusion to the colouring)	D	F FC	Pl	P
		(2) Two animals. Moles	D	F	A	P
IX	2 mins.	Refusal		—		
X	2 mins.	Refusal		—		

* This symbol means "cut-off whole" response.

Tabulation :

R = 7. Refusals—Cards I, III, VI, IX, X.

W	1	4	F +	2	7	A	5	P	5	W	57%
DW	1		F	5		Pl	2	O	0	D	43%
WX	2									F	100%
			(FC)	1						F +	29%
D	3									A	71%

The graph showing the distribution of determinants is seen below.

Assessment.—From a glance at the graph it was obvious that this was a very restricted record where all main responses were form responses. There was only one additional form-colour response. There were refusals of not less than five cards and the total number of responses was only seven. Although the very scanty record made a finer assessment impossible, it pointed definitely to the presence of morbid depression.

The mother's record :

		Performance and inquiry.	Scoring.			
I	1 sec.	(1) A butterfly	W	F	A	P
II	1 sec.	(1) Two dogs. Sitting up, like begging	WX	FM	A	P
III	2 mins.	Refusal		—		
IV	3 secs.	(1) Like somebody walking in the snow. His feet are covered with white snow. His arms. No head. Could be a gorilla hunter	W	M C′	H Snow	Sin.
V	1 sec.	(1) Some beetle. A huge ugly one with a big body, a head and claws	W	F+	A	P sin.
VI	2 mins.	Refusal				
VII	3 secs.	(1) Like little sheep, when they are babies. They are sitting	WX	FM	A	P
		(2) Two figures standing close together. A man and a woman	d	M	H	
VIII	35 secs.	(1) Two bears climbing up a tree. It is a snow-covered Christmas tree	WXS	FM F FC′	A Pl Snow	P
		(2) A butterfly. It is pretty. (Allusion to the colouring)	D	F FC	A	
IX	2 mins.	Refusal		—		
X	20 secs.	(1) Like the face of a rabbit	d	F	Ad	P
		(2) Two dogs	D	F	A	
		(3) A mistletoe	d	F	Pl	
		(4) Like a squirrel	d	F	A	

The scoring symbol "sin." means "sinister." It was introduced by T. Alcock.

Tabulation:

R = 12. Refusals—Cards III, VI, IX.

W	3	6	M	2		H	2		P	6	W	50%
WX	2		FM	3		A	8	9	O	0	D+d	50%
WXS	1		F+	1	7	Ad	1		sin.	2	F	58%
			F	6		Pl	2				F+	14%
D	2	6	(F)	1		Snow	2				A	75%
d	4		(FC′)	1	2							
			(C′)	1								
			(FC)	1								

M : C = 2 : 0

(FM+m) : (Fc+c+C′) = 3 : 0

Last 3 cards 50%.

The graph is shown on the diagram.

Assessment.—The similarity between the psychograms of mother and son was striking. Both graphs were characterized by great bareness. The mother's record showed a remarkable constriction with nothing more than seven form and five movement responses as main responses. The colour-side was completely deprived of main responses. The two achromatic responses and the one form-colour response were additional responses only. The percentage of animal responses was high. Three cards were refused and there were only twelve responses. This was clearly a depressive record. The presence of five movement responses indicated a fair amount of phantasy life, and the fact that the majority of them were animal movements pointed to psychological immaturity.

DIAGNOSIS.

From the history and the clinical observation it was likely that the mother suffered from chronic melancholia, which was a reaction to early experiences in the orphanage and to heart disease. The nature of Allen's disturbance was less clearly recognizable. He was depressed, but whether his depression was due to a truly affective disturbance or was only an additional feature of a hysteric, anxiety or other state could not definitely be decided.

The Rorschach test cleared this differential diagnostic difficulty in an objective and striking way. It showed that Allen's condition was essentially one of morbid depression. It also revealed especially clearly in the graphs a remarkable similarity of the mother's mental state to that of her son. From these findings one could infer that the mother had moulded her son's mind, who was thus overdependent on her. The diagnosis of "folie à deux," which was already considered before the test, was now verified beyond any doubt.

TREATMENT.

Following the usual psychiatric practice of treatment of "folie à deux," the recommendation was made to separate the child from his mother for a time. Fortunately the education authorities were able to place Allen at a suitable boarding-school. He stayed there from October until December, 1948.

Follow-Up.

In November the headmaster of the boarding school informed the clinic that Allen was doing very well in school work, dormitory life and relationships with other boys. He had short periods of quiet retirement, but usually he was full of life and fun and enjoyed the freedom of the woods and hillside.

After his return from school Allen and his mother were seen at the clinic. The mother's opinion could be summed up by her saying, " It has done him a world of good ! " He no longer came crying to his mother, did things independently and stood up for himself. The sleep-walking, too, had greatly improved. Also the mother herself felt more rested and better generally. Allen looked much brighter and happier than before he went to the boarding-school and was more natural and talkative. He retained his shyness, however.

Another Rorschach test was given to Allen and his mother in December, 1948, seven months after their first tests.

Allen's second Rorschach record :

		Performance and inquiry.	Scoring.			
I	20 secs.	(1) It looks like an insect with pincers. It is a wild, prehistoric insect. It could kill you if it were alive	W	F	A	P sin.
		(2) Like a skeleton of a bird. I can see all its bones be-because of the different shadows on the picture. Some shadows are black and others white	W̸	Fk FC′	Ad	sin.
II	3 secs.	(1) Two lambs. They are rubbing noses because they like each other	W̸	FM	A	P
		(2) Now they look like bears kissing each other	W̸	FM	A	P
III	Immediately	(1) Two hardworking kindly looking men fetching water from a well with a bucket. I can just see the sparkling of water	W̸S	M F Fc m	H Obj. Sparkling Water	P P
		(2) A butterfly. It looks like flying	D	FM	A	P
IV	Immediately	(1) A tree. Because this is a stem. Here are leaves and branches. It is an oak tree	DW	F	Pl	
V	Immediately	(1) It looks like an earwig with front prongs. It looks as if walking along the ground ready to pinch you at any moment	W	FM	A	P sin.

Allen's second Rorschach record (cont.) :

		Performance and enquiry.	Scoring.			
VI	1½ mins.	(1) It could be another prehistoric insect with pincers, wings and a tail. It is nasty, not alive	W	F+	A	O sin.
VII	3 secs.	(1) Like two baby deers with bushy tails on a hill. They look at each other	W	FM Fc FK	A Hill	P
VIII	Immediately	(1) Two beavers climbing up a tree. Round here it is green and the centre of the tree is pale brown	WX	FM FC	A Pl	P
IX	Immediately	(1) Two dragons with long noses. They look bold and as if they would like to fight each other. Their mouths look as if they were talking	D	FM m	A	sin.
X	Immediately	(1) Spiders walking to each other	D	FM	A	P
		(2) Little birds with sturdy legs. They look as if they were singing on a branch and were making a twittering noise	D	FM	A	O
		(3) A goat's head with horn, nose and chin	d	F+	Ad	P

Tabulation :

R = 15. No refusals. Longest reaction time 1½ mins. at card VI.

W	4	10	M	1		H	1		P	10	W	67%
WX	4		FM	9		A	11	13	O	2	D+d	33%
WXS	1		(m)	2		Ad	2		sin.	5	F	27%
DW	1		Fk	1		Pl	2				F+	50%
			(FK)	1		Obj.	1				A	87%
D	4	5	F+	2	4	Hill	1					
d	1		F	2		Water	1					
			(F)	1								
			(Fc)	2								
			(FC′)	1								
			(FC)	1								

M : C = 1 : 0

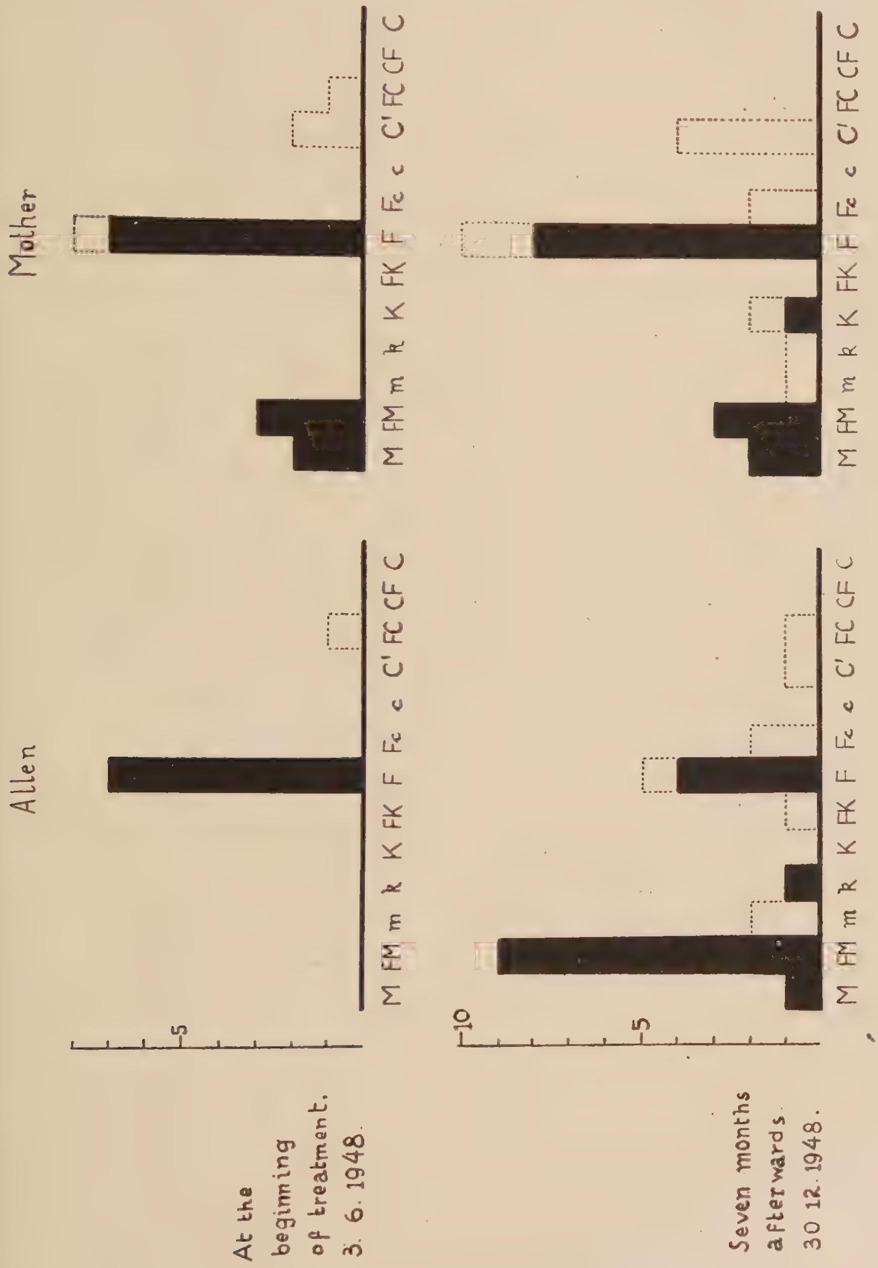
(FM+m) : (Fc+c+C′) = 9 : 0

Last 3 cards 33%.

The graph is shown on the diagram.

Assessment.—The psychogram showed a very marked improvement. There were no longer refusals of cards, and the number of responses had risen from

7 to 15. Form responses no longer predominated, but dropped from 100 per cent. to 27 per cent. Compared with the monotony and bareness of the first



record a considerable variety of dominants enlivened the second record, making the structure of the personality more discernible. A very great number of movement responses had appeared, most of them being animal movements. They showed what a highly imaginative child Allen was, and that he possessed a rich inner life like his mother. There was also one main shading response, probably an expression of anxiety. The number and variety of additional responses had also increased substantially. Most important of them was the form colour response, which was so vividly conceived that it had almost the character of a main response. Main colour responses were, however, still absent which showed that Allen's social adaptation remained inhibited. The other additional responses were likely to be expressions of inner conflicts in a sensitive person. The long reaction time to card VI was probably the sign of a sex shock, as the associations to this card have usually sexual implications. The experience type as revealed by the record was strongly introverted. By studying the contents of the responses we could detect that many of them were of a sinister character, like the prehistoric animals, the skeleton or the dragons. This was most vividly shown by paintings of these responses, which Allen was eager to produce.

The Rorschach test thus demonstrated in an objective way that the resolution of Allen's depression was accompanied by an awakening awareness of his difficulties. Whilst at the time of his deep depression he was not able to face his problems at all and his inner life was as if paralysed, he now began to grapple with his problems and his mental activity came to life.

There was one response which showed especially by its content the extent of Allen's improvement. It was the second response to card X, "little birds singing on a branch." When I applied the technique of "active imagination" by asking Allen to paint the bird just as he imagined it, he produced a touching picture of a pretty bird sitting on a lovely branch. He now said spontaneously, "The little bird is happy."

The mother's second record :

		Performance and inquiry.	Scoring.			
I	1 sec.	(1) A butterfly because of the shape of the wings. A tail	W	F	A	P
		(2) The pointed head of a fox	D	F	Ad	
II	1 sec.	(1) Two dogs sitting up and begging. They are black	WX	FM FC′	A	P
III	—	Refusal		—		
IV	2 secs.	(1) Big feet. They belong to somebody who walks in the snow. He is dressed up like a bear	DW	M C′ Fc (bear-skin)	(H) Snow Ad	P
V	5 secs.	(1) An insect with big wings or rather a bat. I should not like to meet it. Not alive	W	F+	A	P sin.
VI	5 secs.	(1) The upper part looks like an Indian pole with feathers. There they stuck a skull. That is my imagination of horror !	D	F+ Fc Fk	Obj. Hd	sin.

The mother's second record (cont.):

		Performance and inquiry.	Scoring:			
VII	12 secs.	(1) As if somebody has tried to build something of grey snow	W	KF C′	Snow	O
		(2) Two people, one is tall, the other short, man and woman. They walk through a gate in the snow	d	M KF C′	H Obj. Snow	O
		(3) Two dogs standing up and begging. A stick balances on their noses	WX	FM F m	A Obj.	P
VIII	1 sec.	(1) Two bears. They climb up a tree	WX	FM F	A Pl	P
IX	—	Refusal		—		
X	5 secs.	(1) Two crabs	D	F	A	P
		(2) Caterpillars	D	F	A	
		(3) A rabbit's head	d	F	Ad	P
		(4) Mistletoe	d	F	Obj.	

Tabulation:

R = 14. Refusals: cards III and IX.

W	3	7	M	2		H	1		P	8	W	50%
WX	3		FM	3		(H)	1		O	2	D+d	50%
DW	1		(m)	1		(Hd)	1		sin.	2	F	57%
			(Fk)	1		A	7	10			F+	25%
D	4	7	KF	1		Ad	3				A	71%
d	3		(KF)	1		Pl	1					
			F+	2	8	Obj.	4					
			F	6		Snow	3					
			(F)	2								
			(Fc)	2								
			(FC′)	1	4							
			(C′)	3								

M : C = 2 : 0
(FM+m) : (Fc+c+C′) = 3 : 0
Last 3 cards 36%.

The graph is shown on the diagram below.

Assessment.—This record showed a certain improvement in the mother's condition, which was, however, much less extensive than in her son. The number of responses had increased a little from 12 to 14, and instead of 3 cards as at first, only 2 cards were refused. The whole picture was more lively than it was before. One main vista response was this time given which was possibly an expression of anxiety. The variety of additional responses had greatly increased. Additional movement, shading and achromatic responses indicated inner conflicts, insecurity and sadness. The percentage of form responses remained practically the same, but that of animal responses showed a slight tendency to drop. There was neither a main nor this time even an additional colour response. All this showed that the depression still persisted, although it had subsided somewhat. The mother had a strongly introverted experience type as Allen had.

The content of some of her responses gave opportunity for analytical exploration of early and completely forgotten childhood experiences. They were of considerable importance for the understanding of the origin of her depression. An example was the second response to card VII, where she saw : " Two people, a man and a woman." These figures were already seen at the first test, but this time she added : " They walk through a gate in the snow." When she was asked to concentrate on " The gate " and to tell if she could remember a gate which resembled the one seen in the blot she said after a while with signs of surprise : " Oh ! It might have been in the orphanage. We had a big iron gate there. It was very high and nobody was allowed to go out. We children heard that there is an outside world and we tried to climb the gate. But we were always caught. . . ." The man and woman reminded her of her phantastic longing for a father and mother, and also of her dreams to discover the " outside world " together with a man friend. These thoughts were examples of how the contents of Rorschach responses can become valuable starting-points for analytical investigations.

SUMMARY.

The Rorschach method can be of assistance in genetic studies of the personalities of several members of one family.

The test revealed in an objective way the similarity of the personality structure of mother and child at the beginning of treatment.

It helped in making the diagnosis of " folie à deux " and in the choice of treatment.

A re-test after a time of treatment checked the extent of improvement in child and mother objectively and allowed finer observations of the personalities.

It gave also some insight in the mental mechanisms underlying the improvement, and yielded valuable starting-points for analytical exploration.

I wish to thank Dr. A. Elliott, County Medical Officer of Kent, for his permission to publish this paper.

Part II.—Reviews.

Contemporary Religious Jurisprudence. By I. H. RUBINSTEIN. Chicago: The Waldian Press, 1948. Pp. 120. Price not stated.

The author is a member of the Illinois Bar and states that the purpose of his treatise is to clarify and state the civil and criminal legal aspects of the major polemical tenets of fortune-telling, faith-healing and pacificism. He considers that the problems advanced by zealots of these sects, especially during times of war, epidemics, and national crisis constitute a matter of grave public concern. He believes that under the cloak of religion, fortune-tellers would abrogate the laws against speculation and false pretences and produce chaos; faith-healers would repeal all medical and sanitary legislative safeguards and expose the nation to the menace of epidemics, and pacifists would strip the nation of its armed might.

Some whose levels of thought, emotion and behaviour are firmly established may consider it unlikely that contemporary activities of this kind will attain unrestrained power to-day. Others, remembering past history, may feel less assured. Still others will believe that publicity can induce mass suggestibility and become a social menace.

The short passages of the book dealing with the position in America regarding the belief in fortune-telling as an insane delusion, as a defence in murder cases and as it affects civil capacity, as well as the undue influence of a medium, may interest psychiatrists who are frequently called upon to give evidence in courts of law. They may also find some interest in the sections on the criminal aspects of faith-healing, and in the position of Christian Scientists as jurors in personal injury cases, and when mental suffering is said to be due to accident, as well as in cases of alleged neglect to obtain prompt medical care. The legal aspects of pacificism are of more general interest. The book is essentially concerned with the situation in the United States of America.

W. NORWOOD EAST.

Penal Reform: A Comparative Study. By MAX GRÜNHUT. Oxford: The Clarendon Press, 1948. Pp. xv + 486. Price 30s.

The author of this instructive volume sets out to fill the gap between and discuss, from a comparative point of view, the past achievements of penal reformers, the general outlines of institutional and non-institutional treatment, and the particular problems associated with special classes of offenders. He has collected a large amount of material from the literature as well as from official publications, and the book is an important contribution to the subject of penal reform.

It is not easy to read and the amateur penologist is not likely to flirt with the text for long. But the earnest student and the serious social reformer will read it with interest and profit, and will refer to it for a reliable account of the many problems dealt with, including the different manner in which different states have approached similar dilemmas.

The historical account of early prison reform and the rise of criminology, like the rest of the book, is well balanced and well documented. The author points out that prison history is a history of ideals and errors, and that administrative difficulties as well as general prejudices have sometimes checked the pioneer. Some will think that this has advantages as well as disadvantages. For the enthusiastic pioneer does not always convince others, and his views do not always stand the test of time. Moreover, as an eminent modern administrator has stated, the ultimate responsibility for our penal methods rests on the whole body of citizens. And in dealing with human affairs in the raw the method of trial and error has usually proved more practicable and more reliable than a doctrinaire approach. Nevertheless, many readers will agree with the author that there is much truth in his statement that a continual rise of fresh reformative impulses alone can hope to overcome the inevitable human inertia, resentment and misuse of power.

The second part of the book discusses the institutional and non-institutional problems of penology. Here, as elsewhere, throughout the book the reader must assess the statements in strict relation to the context. For an experience in one country may not be comparable to that elsewhere, since better results may be due to more effective planning. He must also be on guard lest examples of individual reactions to prison and punishment blur the general picture. And he must differentiate between them, for in this country an offender is sent to prison as a punishment and not to be punished.

The third and last part of the book deals with juveniles and adolescents, habitual criminals and female offenders. Mentally abnormal offenders and more general matters, such as the trend of penal reform, treatment tribunals and crime prediction are also discussed. The author considers that the pendulum has swung back to-day, and that the modern tendency is to restrict rather than extend the sphere of mental abnormality. He finds that the criminological interest of medical psychology has shifted from insanity to psychopathic personalities, and from the latter to the personality make-up and inner conflicts of normal men and women. For some time past the reviewer has emphasized this aspect, and has found that the difficulties of the subject are not lessened by the fact that some psychologists freely express their views in criminal cases on diagnosis and treatment, which essentially are the concerns of clinical psychiatrists.

The author discusses briefly criminal responsibility and the McNaghten Rules on the usual lines. The inexperienced reader may here erroneously conclude that the Rules are applied in all cases of insanity coming before the criminal courts. He also may not know that the Judges added to their answer to the Lords' Questions II and III that the instructions regarding responsibility should be " accompanied with such observations and corrections as the circumstances of each particular case may require."

The author is to be congratulated on his book; it can be confidently recommended. It is also well produced and is served by a good index.

W. Norwood East.

Hormones and Behaviour. By Frank A. Beach. New York and London: Paul B. Hoeber, 1948. $6.50. Pp. 368.

This book surveys the literature concerning the influence of hormones on behaviour. The bibliography of 65 pages with about 800 references is collected from very varied sources. The subject matter of these papers has been subdivided so as to cover the different categories of behaviour and the author indicates the different types of research and experiment used. He does not attempt to evaluate all the work to which he refers, but leaves it to the reader to consult the original article. A few of the chapter headings will indicate the scope of the book: Courtship and Mating; Oviposition, Parturition and Parental Behaviour; Migration; Homeostasis, Metabolism, Metamorphosis and Moulting; Emotion; Conditioning and Learning, the Role of Nervous Stimulation, Developmental Aspects, etc.

Observations and experiments from a very large number of different forms of life including man are considered. As examples of the kind of information collected may be mentioned the influence of oestradiol on the social organization of hens, of hormones on the nesting behaviour of birds, of sex hormones on the emotional behaviour of rats; the response of fish to mammalian gonadotropins, photo-periodicity in birds and sex differentiation in fowls. Many of the subjects considered are of great importance in animal husbandry and of interest to zoologists, but the book is chiefly intended tor research workers and clinicians.

Much of this experimental work is difficult to apply to man whose behaviour is conditioned by complex cultural and social conditions in addition to his endocrinological status. Suggestion, especially from some silver-tongued gynaecologist, may produce psychic results quite unrelated to the actual physiological effect of the particular hormone used in treatment.

This, however, does not diminish the great value of a comprehensive compilation of data in this field. In the words of the introduction, it will be a book of constant reference for physiologists, psychiatrists, zoologists and sociologists, and for all who are interested in deriving from animal experiments the basic principles to be used in analysis of human behaviour.

W. Mayer-Gross.

Part III.—Bibliography and Epitome.*

ACTA PSYCHIAT. NEUR., SUPPL.

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Genetic-Statistical and Psychiatric Investigations of a West Swedish Population. *Sjögren, T.*	No. 52

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Psychotic Reactions in the Late Recovery Period Following Brain Injury.

In the observation of 500 cases of craniocerebral injury evacuated to an army neurologic center several months after injury, 4 cases of psychosis appeared. These are described in detail.

Two cases may be classified as schizophrenic reactions in which brain injury played a secondary role. At the most, the experience of trauma, brain damage, and resulting state of deficit served as an aggravating factor. Follow-up study revealed neither patient able to pursue steady or gainful occupation.

Two cases may be classified as prolonged, primary traumatic psychotic reactions (confabulatory-amnesic type) in which brain damage appeared to be the outstanding causative factor. Follow-up study revealed that both patients had been able to return to simple, but steady and gainful occupational adjustments despite some intellectual impairment. (Authors' abstr.)

War Crimes: Their Social-Psychological Aspects.

The question may rightly be asked: What should a psychiatrist assigned to the United Nations—if we may anticipate such an event—be looking for in order to find out whether a destructive-aggressive outburst may be expected in any member nation? On the basis of the author's studies in Germany, four signs may be regarded as danger or warning symptoms which might prompt such a psychiatrist of the future to recommend treatment.

The first sign is the prevalence of thinking in destructive rather than in ameliorative terms in dealing with social problems. The ease with which destruction of life is advocated for those considered either socially useless or socially disturbing, instead of educational or ameliorative measures, may be the first danger sign.

A second and probably more basic symptom is the prevalence of fear as a motivating force, both within the social unit and in the relationship of the social unit to the outside world. The author found fear to be one of the most important motivations for those aggressive outbursts which constituted war crimes. The most significant attitude of the nation and the group committing war crimes was that of fear.

We have learned that fear is one of the strongest emotions human beings are capable of. Fear has greater psychosomatic reverberations than other emotions. In any social setting whenever fear is allowed to become a socially motivating force, aggressive-destructive outbursts are to be expected. Fear generates aggression, and aggression in turn generates anxiety and fear.

Whenever within a society fear becomes a significant socially motivating force in the dealings of individuals with each other and in the reactions of society as a whole, it should be interpreted as a significant danger sign.

The third sign is tied up with the second. It is the restriction or abolition of the rights of the individual within a society. Whenever these rights are curtailed or abrogated there are new inroads of fear within the society. The fact that members of the S.S. were individually right-less, that they could be broken easily from officer's rank to enlisted man's rank, gives additional reality to the motivation of fear in contributing to aggressive criminal behavior by members of the S.S.

The fourth sign is the lack of freedom of information. The destructive-aggressive behavior in Germany was partly nurtured by the carefully spread notion that the new code of universal destructiveness was also accepted by other nations—only in a less " open " manner. This misconception based on misinformation about the outside world which was accomplished in Germany by the exclusion of news sources from the outside is difficult to eradicate even to-day. While members of a free society may freely gather their information to the limits of their natural curiosity, the restriction of access to information by any nation should be regarded as a danger sign of potential aggressive-destructive behavior.

It will be left to future society to see whether nations so diagnosed could be treated—and if necessary even certified, committed and confined. The extent to which we may be able to make such an arrangement, we may be able to prevent wars and destructive revolutionary outbursts within society. (Author's abstr.)

Electroencephalogram in Cases with Cortical Atrophy and Ventricular Dilatation.

(1) In a series of 67 cases with unequivocal pneumoencephalographic evidence of either cortical atrophy or ventricular dilatation, many normal EEGs were found as well as a considerable variety of abnormal electroencephalographic patterns.

(2) Those cases of cortical atrophy or ventricular dilatation having convulsive seizures as part of the clinical picture invariably showed abnormal EEGs. In the majority of such cases the electroencephalographic abnormalities were of a marked degree.

(3) In cases free of convulsive seizures, the electroencephalographic abnormalities were generally of a mild degree, and the incidence of abnormality was similar for cases with ventricular dilatation (44 per cent.) and cortical atrophy (37 per cent.). However, more slow activity was found in cases with ventricular dilatation than in cases with cortical atrophy, and more fast activity in the latter group than in the former.

(4) Asymmetrical electroencephalographic abnormalities were recorded in only 5 individuals, 2 of whom had unequal ventricular enlargement. In these 2 the greater electroencephologographic abnormality was on the side of the smaller ventricle. (Authors' abstr.)

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Practical Aspects of Mesantoin Therapy in Epilepsy.

1. Two years' experience with mesantoin shows it to be a highly valuable anticonvulsant drug. It can be used alone in the control of *grand mal*, especially Jacksonian attacks. It may be of some benefit in psychomotor seizures.

2. The authors have found that mesantoin is best combined with dilantin sodium. Dilantin sodium is still perhaps the most effective anticonvulsant remedy and should be the base upon which other drugs are added.

3. The dosage of mesantoin and dilantin sodium must be individualized and adjusted to the need of the patient. May we impress the goal of a limited number of spells, not a reduced number of pills?

4. A common effective dose for adults is dilantin sodium 1 to 3 capsules, and mesantoin 4 to 6 tablets daily. This combination has proved more effective in controlling seizures than any previous single drug or combined drugs which the authors have used.

5. Side actions of mesantoin include drowsiness and skin rash. As a rule patients acquire tolerance to the drowsiness in a period of time. Dexedrine and physical activity tend to free the patients from the somnolence.

6. Effective control of an epileptic requires close and continued observation and treatment. (Authors' abstr.)

Psychological and Physiological Effects of Intravenous Pervitin.

1. The physiological and psychological effects of i.v. pervitin, sodium amytal and benzedrine were studied in 75 psychiatric cases.

2. Pervitin has cephalotropic and sympathicotropic effects. It is a more potent cephalotropic and less potent sympathicotropic drug than benzedrine.

3. Pervitin produces an emotionally charged free flow of material, which may include painful memories, traumatic experiences, intimate personal phantasies, and delusional ideas. Most patients experience a dramatic relief of tension and feeling of relaxation. Mild depressions are often delayed. The psychologically rich response evoked by pervitin is helpful both diagnostically and therapeutically.

4. The physiological effects of pervitin include evaluation of blood pressure for 24–36 hours, alteration of pulse rate, dryness of the mouth with thirst, loss of appetite, tightness in the chest, increased awareness of the environment and of sensory stimuli, elimination of fatigue, and wakefullness.

The EKG is not significantly altered. The EEG shows no striking change in basic frequency pattern despite pronounced psychophysiological effects. There is a slight decrease in alpha wave output during the stage of tension and hyper-alertness.

5. A comparison of pervitin with sodium amytal and benzedrine reveals the following:

(*a*) In contrast to sodium amytal, pervitin evokes a more spontaneous, richer and more appropriate response. In some cases, when sodium amytal fails to produce a response, pervitin succeeds. With pervitin there is no loss of consciousness or amnesia for the interview. All the material dealt with during the pervitin interview may be recalled, and is available to the patient's consciousness for integration and assimilation.

(*b*) Benzedrine in doses of 20 to 40 mg. produces similar physiological effects as pervitin, but fails to produce the same intense psychological response. The productions with benzedrine lack the depth and personal significance of those with pervitin.

(*c*) Pervitin may counteract the hypnotic effect of amytal, and amytal may calm the over-excitement occasionally induced by pervitin.

(Authors' abstr.)

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Neurocirculatory Asthenia, Anxiety Neurosis or the Effort Syndrome.

1. Terminology concerning this disorder is confused, with no satisfactory distinction between neurocirculatory asthenia, anxiety neurosis, effort syndrome, neurasthenia, psychoneurosis, combat fatigue and other terms.

2. Symptoms are multiple and high in incidence. In contrast, physical signs are few.

3. Studies of muscular work demonstrate short duration of performance in hard work and a defect in aerobic metabolism in all grades of work as evidenced by oxygen consumption and blood lactate concentration. Pulmonary ventilation is abnormal during work, as is ventilatory efficiency.

4. Ventilation index and awareness of dyspnea are abnormal.

5. The pulse rate for all grades of exercise is abnormally high. The capillaries of finger nail folds are abnormal. The size of the heart, the electrocardiograms and the resting circulatory measurements, including cardiac output, are normal.

6. Quantitative studies of pain and discomfort show abnormal reaction to painful stimuli.

7. Psychologic tests place patients with neurocirculatory asthenia in the "neurosis" category.

8. The incidence of neurocirculatory asthenia is high in mothers, fathers, brothers and sisters of patients with the disorder. If the disorder is hereditary, the data suggest mendelian dominance.

9. The cause, anatomic changes and specific treatment are obscure.

10. The symptoms, onset and exacerbations are influenced, according to patients' biographic reports, by muscular work, emotion-provoking situations, infection or nothing at all. The difficulties in interpreting this type of data are emphasized.

11. A convenient distinction was made on the basis of history alone between acute and chronic neurocirculatory asthenia. In this study "acute" refers to the disease in patients with a convincing history of previous health and ability to do hard work. "Chronic" refers to the disease in patients who had never been able to do hard work or athletics.

12. In all studies in which differences existed between patients and healthy controls, mean values for those with the acute form of the disease fell between those for controls and those for patients with the chronic form.

13. It is emphasized in studies of this disorder, and perhaps in many others, that basal measurements made with the patients resting may not show abnormalities, while measurements made while the patients are under stress may; the stronger the stress the greater the deviation from normal. (Authors' abstr.)

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Injury of the Central Nervous System Resulting from Decompression to Simulated High Altitudes.

During the course of altitude indoctrination of persons undergoing flight training in the Army Air Forces, a small number of neurologic reactions have been observed. The occurrence of these reactions in an altitude chamber provided an ideal opportunity for observing the chain of events which follows a bout of decompression sickness.

Neurologic reactions occurred in two phases—an early, or primary, reaction, appearing during or shortly after a flight, and a delayed, or secondary, reaction, occurring up to twelve hours after descent. Case reports of such reactions are presented.

The primary type of reaction is due to the lodgment of air bubbles within the cerebral vessels. It is possible that vasospasm resulting from the lodgement of the bubble may be an additional factor in the development of symptoms.

The delayed reaction is also vascular in origin and results from a change in permeability of the vascular wall secondary to its occlusion during the flight. On the disappearance of bubbles after descent, the damaged vessels become dilated; the blood is stagnant, and the walls are permeable. Leakage of fluid results in cerebral edema and diffuse disturbance of cerebral function. At autopsy, flattening of the convolutions, a gelatinous exudate and, occasionally, small hemorrhages are noted.

The trauma which leads to the cerebral vascular reaction observed in these patients is an unusual one. However, the mode of reaction of the blood vessels is probably not unusual, and, as has been suggested by Aring, may play a part in the development of symptoms in a number of other diseases of the brain.

(Author's abstr.)

Modification by Curare of Circulatory Changes. Changes during Electrically Induced Convulsions in Man: A Note on D-Tubocurarine.

The administration of curare before induction of convulsive seizures reduces the degree of rise in venous pressure caused by convulsions; changes in the electrocardiograms of curarized patients given electroshock therapy are similar to, but generally less prominent, than those of uncurarized patients. An apparent exception is the frequent occurrence of ventricular premature beats after seizures in curarized patients; this finding is difficult to evaluate, since the patients of the present study were for the most part well advanced in years. It is concluded also that d-tubocurarine has all the effectiveness of "intocostrin" and lacks some of its drawbacks. (Authors' abstr.)

Fall in Plasma Protein Level Associated with Rapid Gain in Weight during Course of Electroshock Therapy.

A transitory decrease in plasma protein level accompanies the gain in weight which ushers in clinical improvement in patients receiving electroshock therapy. The correction of dehydration accounts only in part for this change. The studies suggest the occurrence of a transitory loss of protein from the circulation, and the pattern of change is that which occurs in patients who, after a period of depletion, begin to store tissue protein. (Authors' abstr.)

Reflex Studies in Electroshock Treatments.

1. Plantar areflexia followed electroshock convulsions in 93·8 per cent. of 500 treatments.

2. In 25·6 per cent. of the 500 treatments a Babinski sign was noted after short, variable intervals of plantar areflexia.

3. *Petit mal* seizures were not followed by any change in the plantar reflex. (Authors' abstr.)

Effect of Optic and Acoustic Stimuli on the Cortex and Hypothalamus Under Conditions of Picrotoxin Convulsions.

The effect of optic and acoustic stimulation on cortical potentials and movements was investigated under the influence of increasing degrees of picrotoxin poisoning. The results were as follows:

With progressing degrees of intoxication, the sensory response elicited in the specific cortical projection areas increased in amplitude and also became repetitive. Moreover, sensory responses similar in quality and quantity appeared in previously non-responding cortical areas (including the suppressor areas) and in the hypothalamus. The motor cortex was not particularly sensitive to picrotoxin discharges, since responses to an acoustic stimulus appeared in non-acoustic projection areas, while they were absent in the motor cortex. Optic or acoustic stimuli may elicit or intensify convulsive movements, but these reactions were mostly confined to the moment of stimulation. Generalized convulsive movements were not induced with these stimuli. (Authors' abstr.)

Follow-up Study of Men with Penetrating Injury to the Brain.

One hundred men with penetrating damage to the brain were followed for more than six months after discharge from an Army hospital (one or two years after injury). Sixty were found formally employed or attending school.

Twenty-eight had required further medical care for symptoms referable to craniocerebral injury. Only 4 were institutionalized for continued care in veterans' hospitals.

Paralysis, hemianopsia, sensory loss and even residual "aphasic" signs were of less concern to the patient than were disturbances of consciousness, headache and emotional reactions.

Sixty-two men showed significant and continued improvement. Headaches were commoner among those who had them while hospitalized and those with less severe damage to the brain.

At the time of follow-up study, 34 men had had at least one convulsive seizure. The onset of such seizures was usually between the fourth and the ninth month after the wound was received.

Extent of disability is determined by the severity and location of intracranial damage and by the multiple social and personality factors borne by the patient who experienced the injury. (Author's abstr.)

Sleep-Electroshock Therapy of the Psychoses.

Sleep-electroshock therapy is a modification of the orthodox electroshock treatment in which the patient is induced to sleep by the intravenous injection of "sodium pentothal" prior to the application of the electric current. By this means patients who would themselves have discontinued shock therapy because of fear and patients who, because of their unmanageable psychomotor reactions, would have to be denied treatment by the physician, have been treated successfully.

No complications have been observed in the course of over five hundred treatments. On the contrary, by the careful gaging of the depth of anesthesia, one may selectively evoke minor, medium or major reactions. (Author's abstr.)

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Lumbar Puncture Headache.

(1) In 11 subjects with lumbar-puncture headache, pain often spread to the back of the neck and even into the trunk. Neck rigidity was common.

(2) Cerebrospinal fluid pressure in the horizontal posture was observed to be about atmospheric in 6 cases and within the lower limit of normal in 1. In all these 7 cases injection of 30 to 50 c.c. saline, sufficient to restore the pressure to the normal or upper normal range, abolished the headache.

(3) Headache was invariably increased by sitting up and relieved by lying down. It was usually increased by compression of the jugular veins in the neck, and by shaking the head. Not infrequently the headache throbbed with the pulse and in about half the cases was relieved by compression of the carotid artery in the neck.

(4) Lumbar-puncture headache is ascribed to caudal displacement of the base and posterior parts of the brain with tension on the anchoring structures, particularly the tissues around the large arteries at the base. (Author's abstr.)

Projection of the Centromedian Nucleus of the Human Thalamus.

From a histological study of five human cases with lesions in the basal ganglia evidence is educed that the centromedian nucleus of the thalamus projects to the striatum and not to the globus pallidus. (Author's abstr.)

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Effects of Supranormal Glutamic Acid on Maze Learning.

In an experiment designed to test the reported special influence of glutamic acid in mental functions, 125 growing white rats were divided into three groups and for a total of six weeks were given daily dietary supplements of glutamic acid, glycine, or distilled water. No statistically significant differences, either in original water maze learning or in re-learning, were found between any of the groups. These results are interpreted as failing to confirm, under the experimental conditions of this study, the earlier reported improvement in white rat learning performance following supranormal ingestion of glutamic acid. Two possible explanations of the discrepancy in results are discussed, but direct experimental evidence in support of either is lacking. It is suggested that further investigations be made and reported to test the mental effects of this dietary factor.

(Author's abstr.)

The Development of Conditioned Responses in Cats After Unilateral Decortication.

1. Twelve normal and 12 unilaterally decorticate cats were studied in a shock-avoidance conditioned response situation. The conditioned stimulus was auditory and a flexion of either of the pair of legs being studied resulted in the avoidance of the unconditioned stimulus.

2. In the case of the unilaterally decorticate cats:

(*a*) The conditioned responses were almost invariably flexions of the stimulated leg when the unconditioned stimulus was applied to the foot contralateral to the intact cortex.

(*b*) The conditioned responses tended to be flexions of the unshocked leg when the unconditioned stimulus was applied to the foot ipsilateral to the intact cortex. This tendency was less marked if the cat had previously been trained in a situation involving a response of the diagonally opposite leg.

(*c*) There was no significant difference between the rates of learning under either of the conditions described under 2 (*a*) and (*b*).

3. In the case of the normal cats it was found that:

(*a*) The conditioned response tended to be flexion of the shocked leg.

(*b*) The number of conditioned responses involving the unshocked leg (unshocked leg and both leg conditioned responses) was significantly greater than those given by the unilaterally decorticate cats trained with the unconditioned stimulus applied to the foot contralateral to the intact cortex. (Author's abstr.)

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The Effects of Tridione on Audiogenic Fits in Albino Rats.

Two experiments were designed to test the effect of Tridione in normal and excessive doses on the incidence of running fits induced by auditory stimulation in domestic albino rats. Two groups of animals, totalling sixteen subjects, were tested under auditory stimulation to determine their susceptibility to sound induced convulsions. The rats used as subjects all showed running type fits when stimulated with an electric bell. Experimental animals were injected intraperitoneally with varying amounts of a 1 per cent. Tridione solution; controls with similar amounts of distilled water. Subsequently, animals were retested under auditory stimulation to determine the effect of such treatment on the incidence of audiogenic seizures.

Animals given normal (based on average human dosage) doses of Tridione were not visibly affected by the drug so far as incidence of audiogenic seizures was concerned. Rats given large doses of the drug showed a decrease in percentage of audiogenic fits. Tridione does not have a uniform effect on all animals; individual differences relative to the incidence of seizures following drug treatment were present.

None of the control animals, given intraperitoneal injections of distilled water, showed any marked changes in susceptibility to the sound-induced convulsions. It was concluded that Tridione, when used in large amounts, is effective in alleviating running seizures induced in albino rats by auditory stimulation. No conclusive statement could be made regarding the relation of running fits in rats to psychomotor or *petit mal* epilepsy in humans. (Authors' abstr.)

Maze Learning as a Function of Added Thiamine.

A group of 30 young white rats was given daily dietary supplements of 100 micrograms of thiamine (vitamin B_1), for purposes of comparison with a control group of 33 rats given only distilled water. After four weeks of daily stomach feeding of the supplements, with stock feed and water available at all times, the thiamine-supplemented animals failed to excel the controls in the learning of a 14-unit T-water Maze. Similar negative results were found on a relearning test after an additional two weeks of dietary supplementation. The data are interpreted as demonstrating the ineffectiveness, so far as psychological improvement is concerned, of adding large amounts of thiamine to the normal stock diet of the laboratory rat, in a manner similar to that reported by Harrell to have resulted in significantly greater psychological efficiency in children. They are interpreted as extending the essentially negative results of earlier studies on identical twins by Robertson *et al.*, and on rats at lower levels of thiamine intake by Lush. Possible reasons for the discrepancy in results are discussed, and the positive results of the Harrell study are suggested to be an artefact of increased motivation, developed by the experimental conditions under which increased appetite was not followed by increased food intake, rather than of any specifically improved learning ability. Evidence for this reinterpretation of the Harrell data is presented by means of a detailed comparison of the methodology of the Harrell and Robertson experiments. It is concluded that while no unequivocal demonstration of a genuine facilitation of learning from added thiamine has been made, the implications of the problem are so great as to justify further controlled experimentation.

(Author's abstr.)

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Hypnotic Neuroses: Hypochondriasis and Depression.

An attempt was made to satisfy Koch's third postulate in the field of clinical psychology. A group of 15 college students took the MMPI in four ways: Normal and in three different hypnotic states. The hypnotic states were hypochondriasis, depression, and a third control state called inverted depression in which the depression instructions were repeated in antonym.

The attempt to induce hypochondriasis as a so-called "pure" neurosis failed to obtain in pure form, but yielded scores that were essentially the same as those of clinical cases diagnosed as hypochondriasis. The results of the attempt to induce depression were satisfactory with the exception of the behaviour of the F, the Pd and possibly the K scores.

The evidence indicates that the hypnotic neurosis is neither a simulated state nor a test-taking attitude.

It is felt that Koch's third postulate was satisfied in the case of the induction of hypnotic hypochondriasis, and that it was partially satisfied in the case of hypnotic depression. (Author's abstr.)

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Experimentally Induced Convulsive Reactions of Laboratory Rats. II. A Comparative Study of Post-convulsive Maze Behaviour.

For the experiments involving the use of a running food-reward T-maze, the observational facts may be detailed as follows:

(1) The change in the rat's maze behavior produced by 30 periods of exposure

to three minutes of noise-fright stimulation with an average daily incidence in the experimental animals of 62 per cent. typical abnormal hyperkinetic, cataleptic or convulsive reactions is reflected in an increase in time spent in the maze during at least the first five trials of relearning on the 20th day after the last of 30 daily experimentally induced noise-fright reactions.

(2) There was no experimental evidence suggesting that the retention of the maze habits, insofar as error scores were concerned, was disturbed any more demonstrably than in control animals which had no noise-fright experience.

(3) The general maze behavior of the NF rats was characterized by evidence of hypervigilance and easily frightened behavior which disappeared, at least to gross observation, after a few trials in relearning the maze.

(4) The change in the rat's maze behavior produced by 30 daily electroshock convulsions is reflected in an increase, relative to control animals, of time spent in the maze during the first 5 to 10 trials of relearning on the 20th day after the last electroshock convulsion.

(5) The animals subjected to the electroshock convulsive experience showed an error of performance in relearning which was not significantly different from the error performance of the first trials of the original learning.

(6) The general maze behavior of rats following 30 consecutive daily electroshock convulsions was characterized by easily startled and frightened behavior which progressively diminished in intensity as relearning proceeded.

(7) Electroshock convulsions produced more complete and more rapidly manifest avoidance reactions and evidence of fear in the experimental animals than did similar numbers of noise-induced abnormal reactions.

For the experiments involving the use of a swimming water-maze, the following conclusions are supported by the experimental data :

(8) There was no evidence for assuming any significant difference in the initial rate of learning between the group of animals susceptible to noise-induced behavior disturbance and the rats selected for the ES group which were not easily susceptible to noise-induced behavior disorders.

(9) Electrically induced generalized convulsions produce changes in the rat's behavior which result in relatively long-lasting post-convulsive reactivation of choice-point errors in an already perfectly learned maze.

(10) After there is evidence of spontaneous recovery from the immediate effects of both electroshock convulsions and noise-fright reactions, the error occurrence in the maze performance of the rats in which electrically induced convulsions have been produced is significantly greater than the error frequency in the maze swimming of rats which have been subjected to noise-evoked behavior disturbances.

(11) The maze errors made by the noise-disordered rats in the three-trial post-recovery period became progressively less as the experimentation continued. A progressive betterment of time scores was related to the observed decrease in errors. This post-recovery betterment of time and error scores did not occur for the electroshock group. In other words, the NF animals appeared to " adapt " to the post-recovery maze experience.

(12) Continued experience with the experimental procedures of electroshock and noise-fright stimulation resulted in decreased swimming time in the maze in the daily single trial before the experimental reactions were induced, when the animals were free from any immediate or post-recovery effects of electroshock convulsions or of noise-fright reactions.

(13) Rats which undergo electroshock convulsions of a generalized nature remain in the maze for a much shorter time in the immediate post-convulsive trials than do animals which have been subjected to electrically induced " catatonic " reactions or to noise-induced abnormal behavior reactions.

(14) Rats subjected to electrically induced " catatonic " reactions observationally like typical noise-fright responses spent significantly less time in the maze in the immediate post-reaction trials than did animals in which the typical abnormal behavior pattern was produced by noise-fright stimulation. These observations confirm the findings previously reported in that the noise-fright induced abnormal reactions resulted in a longer lasting post-attack catalepsy and generalized inhibition than that seen after electrically induced noise-fright-pattern responses or than that observed after generalized electroshock convulsions.

(15) When rats which usually reacted to noise-fright stimulation with the typical acute behavior disorder occasionally displayed no such reaction when subjected

to the noise-fright situation, their post-stimulation maze swimming approached the limits of optimal speed possible for the maze. The noise-fright stimulation, when it did not result in the motor expression of the abnormal behavior pattern, nevertheless produced an effect on immediate maze behavior by increasing the speed of swimming out of the maze. In terms of motivation, the noise-fright experience apparently enforced the ordinary escape-motivation engendered by the maze. This further supports the hypothesis that the noise-induced behavior disturbance of the rat represents a prototype acute disorganization of behavior as a reaction to fright.

(16) From the standpoint of maze behavior, noise-induced reactions in which running only occurs result in as long lasting absence of locomotor swimming in the presence of the continuing escape-motivation as the catalepsy and inhibition seen after the more typical abnormal behavior pattern ending in a hyperkinetic convulsive phase after the period of initial running. This is additional evidence that the psychological factors determining the abnormal noise-induced behavior disturbance are at least as significant as the neurophysiologic determinants.

(17) Rats subjected to noise-induced abnormal behavior disturbances manifested a significant tendency to move from the start-box upon being placed in the maze immediately following the acute phase of the reactions, although these animals spent a much longer total time in the maze during this period than did animals subjected to electroshock convulsions. Some of the noise-fright rats moved immediately out of the start-box, even though they swam with great difficulty. The general behavior of the electroshocked rats was to wait in the start-box until they recovered their ability to swim and then to swim through the maze without stopping until they reached the exit-platform.

(18) The electroshocked rats had to swim actively for a significantly longer time to reach the goal-exit after locomotion was begun than did animals subjected to noise-induced reactions. The electroshocked rats apparently suffered a temporary cognitive disturbance as one of the results of the electroshock convulsion, which severely affected maze performance for a varying time. This disturbance resulted in the rat's failure to make correct choice-point discriminations, and the swimming time spent in reaching the goal was accordingly lengthened.

(19) The demonstration of a much shorter active swimming time in the maze after noise-induced reactions coexisting with a significantly greater total time, active and inactive, as compared to the electroshock animals, indicates that the initial movement by the noise-fright rats out of the start-box is not, probably, a part of the goal-seeking active swimming behavior, but is another kind of motivational activity specifically related to the start-box situation, probably a carrying-over to the maze-situation of the escape-tendency developed in the noise-fright experience.

(20) The generally last-learned choice-point discrimination in the maze learning process was the choice-point at which the electroshock rats made the majority of errors in maze trials occurring in the recovery period after generalized convulsions. The electroshock convulsions, therefore, affected last-learned responses more than first-learned choice-point discrimination.

(21) The generally last-learned choice-point discrimination in the maze in the original learning process was the choice-point at which the noise-fright rats made the majority of their VTE movements in maze trials occurring in the recovery period after typical noise-fright reactions. Discrimination behavior at the last-learned choice-point was more disturbed by the noise-fright experience than the discrimination behavior at the first-learned choice point.

(22) Although electroshock convulsions produce severe maze performance dysfunction in the rat, there is significant evidence of the retention of the general characteristics of the maze experience even during the initial post-convulsive trials when the severe performance dysfunction is most manifest. The disturbance produced in the rat's behavior by electroshock convulsions affects immediately the choice-point discrimination performance, while the more general orientative behavior, such as the forward-going tendency, and the inhibition of futile, exploratory diving is not manifestly disturbed.

(23) Rats which had no previous experience with the maze and which had never been in water made more errors and took significantly longer to swim the maze to the escape platform after an electroshock convulsion than unshocked control animals in their first experience with the maze.

(24) No differential error or time effects existed between the two experimental groups of electroshocked and noise-frightened animals in their maze performance 30 days after their experience either with 10 daily noise-fright exposures or with 10 daily electroshock convulsions.

(25) In terms of error or time scores, no significant effects of the experimental experience on maze performance was observed in either the electroshock or noise-fright group of animals 30 days after the last electroshock convulsion or noise-fright reaction.

(26) The effects of 10 electroshock convulsions massed into a five-hour period are not reflected in error or time scores in the maze performance of rats in an already learned maze at 24 hours after the last convulsion. On the other hand, the effects of such a convulsive experience in increased swimming time and the occurrence of errors is manifest for at least two hours afterwards. Accordingly, it follows that electroshock convulsions must be considered to produce a transitory cognitive dysfunction in the rat and not to produce any actual trace-loss of recently acquired maze-learning. (Author's abstr.)

Incidence of Colour-blindness among Psychotic Subjects.

The incidence of colour-blindness among the psychotic patients tested by the authors is not significantly higher than among the normal population.

In their opinion the contrary finding by Kaplan and Lynch was in major part due (*a*) to poor selection of the colour-blindness test used in their study; (*b*) to ignorance of the many random errors which non-psychotic subjects whose colour vision is normal make on this test; and (*c*) to inadequate criteria on which to diagnose the presence of defective colour vision. Lack of control of conditions under which the test was administered may also have been a contributing factor. (Authors' abstr.)

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Tetra-ethyl Ammonium Chloride as an Adjunct in Treatment of Psychovisceral Manifestations of Anxiety.

Tetra-ethyl ammonium chloride is relatively harmless, inexpensive and easy to administer. It produces a complete, though temporary and reversible, block of all autonomic ganglia. It is an excellent tool in the study of the functions and dysfunctions of the autonomic nervous system. It can be administered satisfactorily to ambulatory patients. The intramuscular route is preferable in most instances.

Observations were made on the clinical effects of tetra-ethyl ammonium in 48 patients having varying types of neuroses. The effect of the drug on patients with a pure anxiety state is fairly uniform, predictable and beneficial. The effect on patients with a conversion neurosis or psychasthenia is unpredictable and varied. In general, tetra-ethyl ammonium chloride serves as a useful symptomatic device in weakening at least one of the links in the psychovisceral complex responsible for some of the subjective and objective discomforts in patients with anxiety neuroses. (Authors' abstr.)

Autonomic Nervous System Changes Following Electric Shock Treatment.

(1) Individuals vary in their autonomic patterns. Seven patterns are described. Eighty per cent. of the controls fall into two autonomic groups that contain only 20 per cent. of the mentally ill. These patterns can be altered by electric shock. (However, these changes are not specific for electric shock, as they can be altered by other modes of therapy and by spontaneous changes in the patient's psychological picture.) The question of cause will immediately come to the mind of many.

With that question we are not concerned in this paper except to state that the psychological and the physiological seem to be parts of the same process. When the psychological picture changes, the physiological picture changes and *vice versa*. They seem to fit as a "hand into a glove."

(2) The autonomic patterns are not specific for any diagnostic category. However, from an analysis of the data it would seem that there is some affinity of certain diagnostic categories for particular autonomic groups, i.e., the distribution is not random. For example, Group IV is mainly neurotics, Group V, schizophrenics and Group VI agitated depressions. There is a possibility that this reflects the selectivity of the cases.

(3) There are definite autonomic changes with electric shock, i.e. provided the clinical picture changes. These are:

(*a*) Increased reaction to epinephrine.
(*b*) Decreased reaction to mecholyl.
(*c*) Decreased basal blood pressure.
(*d*) Changed blood pressure grouping.

We believe that the overall effect of electric shock treatment is to lower the basal sympathetic tension, especially if it has been increased by the illness, and at the same time increase the reactivity of the sympathetic nervous system to stimulation. Decreased reaction of the parasympathetic nervous system to stimulation is often a corollary.

If an anxiety component is present in terms of the authors' test, the following are the likely changes following electric shock treatment:

(*a*) Anxiety precipitated by epinephrine is increased.
(*b*) Anxiety precipitated by mecholyl is relieved.
(*c*) Anxiety temporarily relaxed by mecholyl presages a good result with electric shock.
(*d*) A chill after mecholyl is abolished.

From their studies they can predict that a good outcome with electric shock treatment may occur in cases that show some of the following features:

(*a*) Initial autonomic grouping VI or VII.
(*b*) Anxiety precipitated or relaxed by mecholyl.
(*c*) A chill after mecholyl.

(5) A word of caution: The cases that were shown as examples were the most typical in order to give a clear impression. In many cases there is a combination of factors, for example, a person may fall into a "shock-sensitive" group and have anxiety of the type precipitated by epinephrine. Judging from the autonomic grouping, we might predict a good outcome; on the other hand, epinephrine precipitable anxiety usually suggests a poor outcome. Much more experience is necessary in order to predict the changes in such complex cases.

(Authors' abstr.)

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Psychological Effects in Depressive Patients of Synhexyl.

The effects of synhexyl, a homologue of one of the active principles of marihuana, have been investigated in a group of patients with predominantly depressive characteristics. The symptoms produced were those of general impairment of cerebral function and mild clouding of consciousness. No evidence that the drug is valuable as a treatment for depression was obtained. The symptoms produced were in contrast to those of benzedrine in the same group of subjects. These findings are discussed in relation to the mechanism of action of the drug.

(Author's abstr.)

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Inhibitory Action on a Motor Nucleus and Focal Potentials Generated Therein.

Focal potentials have been recorded in the quadriceps motor nucleus in response to inhibitory volleys in homogeneous groups of afferent fibres. Inhibitory volleys in the *large* proprioceptive afferent fibres of hamstring and of gastrocnemius nerves are thus shown to be transmitted directly into the proximity of the quadriceps nucleus. There they set up positive focal potentials, which, when uncomplicated by interneuronal after-discharges, resemble inverted synaptic potentials, i.e. synaptic potentials recorded when the needle electrode is closer to the " source " of the axon than to the " sink " of the soma and dendrites. Such positive potentials have a time course similar to the simplest form of inhibitory effect exerted on the quadriceps nucleus, the unitary inhibitory curve of Lloyd. Hence it may be concluded that the observations conform with the Golgi-cell hypothesis of inhibition, which postulates that such "direct" inhibition exerted by the large proprioceptors is mediated by the subliminal activation of Golgi cells, whose axons produce anelectrotonic foci on the motoneurones by virtue of the current flow so engendered.

On the other hand, the focal potentials show that cutaneous afferent volleys terminate much more distantly from the quadriceps nucleus, and the positive focal potential which they set up in that nucleus is not directly relatable to their inhibitory effect either in time course or intensity. All observations confirm with the explanation that initially the positive focal potential is generated at the synaptic relay in the dorsal horn and that impulses discharged from there may then either "directly" or after further synaptic relay exert an action on the quadriceps nucleus comparable with that "directly" exerted by hamstring or gastrocnemius impulses through the Golgi-cell mechanism.

However, much further investigation is required for the rigorous testing of these explanations. Furthermore, the tests that the authors have made on the postulated explanation of the secondary facilitation (Lloyd) have given equivocal results. (Authors' abstr.)

Synaptic Potentials of Inhibited Motoneurones.

According to the Golgi-cell hypothesis of inhibition, the spread and fusion of the local responses set up by synaptic excitation of a neurone are limited by anelectrotonic foci generated by current flow in activated Golgi cells. Thus it would be predicted that, during concurrent inhibition of motoneurones, there would be a depression only of that part of the synaptic potential which is attributable to the phase of spread and fusion of local responses. Experimental observations with both focal and ventral root recording of synpatic potentials have conformed with this prediction, for, as a rule, an inhibitory depression of the synaptic potential becomes first observable only when the upward inflection of the synaptic potential signals the rapid growth and fusion of the local responses to form a propagated impulse. This mechanism of inhibitory action has been demonstrated for both "direct" and "secondary" inhibition.

In addition, two modes of inhibitory action by blockage of the incoming excitatory volley have been observed when the inhibitory volley is large—as, for example, when it is set up in an adjacent dorsal root. As is well known, (i) the dorsal root reflex discharge may cause a partial blockage by collision, but there may be, apart from such action, (ii) a blockage in the butable to the low safety factor for propagation in this region together with the catelectrotonic depressant action of the dorsal root potential. (Authors' abstr.)

Inhibition of Antidromic Responses of Motoneurones.

An afferent volley in a muscular or cutaneous nerve that inhibits the reflex response of a motoneurone may also cause blockage of antidromic propagation from the axon into the soma, but three dissimilarities show that these two inhibitory actions are not identical (i) the latent period of the antidromic depression is longer by 0·5 to 1·5 msec. (confirming Renshaw); (ii) no antidromic depression has been observed to be associated with the "direct" inhibitory action of group I muscle proprioceptor impulses, and even with the "secondary" inhibitory action exerted by impulses in smaller afferent fibres, the reflex inhibition may be total, while the antidromic inhibition is slight or negligible; (iii) it has been shown that deep anaesthesia may abolish the inhibition of antidromic propagation, while the monosynaptic facilitatory action is much less affected.

Comparable observations have been made with that group of quadriceps motoneurones into which an antidromic impulse can enter only when it is facilitated by a preceding excitatory volley from quadriceps proprioceptors. A preceding inhibitory volley likewise may block antidromic transmission into such facilitated motoneurones, but again there are the above three dissimilarities between such inhibition and reflex inhibition.

Since the facilitation of the antidromic soma spike of quadriceps motoneurones by a volley in group I quadriceps proprioceptors follows the time course of the synaptic potential, such a facilitation curve has been used as a test of the action of an inhibitory volley on the synaptic potential. In conformance with the directly observed synaptic potential in the previous paper, inhibitory depression is first observed late on the rising phase or at the summit of the synaptic potential, and thereafter increases during the early part of the decay, which is consequently expedited. Similarly, this inhibitory effect is associated with "direct" as well as "secondary" inhibitory action.

The mechanism of antidromic propagation into a motoneurone is discussed, and it is shown that the Golgi-cell hypothesis of inhibition offers plausible explanations of the above three dissimilarities between reflex and antidromic inhibition.

Finally, it is shown that the experimental investigations of the present paper and the two preceding may be satisfactorily explained in terms of the Golgi-cell hypothesis, whereas other hypotheses fail in important respects. and probably the other postulated mechanisms are of little significance in normal reflex co-ordination. (Authors' abstr.)

Anatomical Considerations of Monosynaptic Reflex Arcs.

The occurrence of monosynaptic reflex arcs in the central nervous system was investigated by the "bouton degeneration method." The results furnish direct anatomical evidence for facts long ago postulated by physiologists:

1. The monosynaptic path of stretch reflexes.
2. The stretch afferent function of neuromuscular spindles.
3. The absence of other kinds of two-neuron reflexes in the central nervous system, even in other kinds of proprioceptive muscular reflexes.

Morphological evidence of the existence of direct inhibitory collaterals from stretch afferents to motoneurons of the respective antagonists has been found.

It has been shown that there is no direct (monosynaptic) connection between primary sensory and preganglionic vegetative neurons. (Author's abstr.)

Analysis of Forelimb-Hindlimb Reflex Activity in Acutely Decapitate Cats.

Stimulation by single shocks of forelimb nerves evokes a variety of reflex effects in the ipsilateral hindlimb motor nuclei of the acutely decapitate preparation. The dominant excitor reflex is one of extension rather evenly distributed over the extensor musculature of the hindlimb.

A "concealed" type of excitor reflex concerns the hindlimb flexors. It is detectable in the decapitate preparation only by exploring with monosynaptic test reflexes the excitability of motor nuclei. This reflex is concentrated at the knee, rather than at ankle or digits.

Another reflex disclosed may be called the inhibitory reflex of flexor longus digitorum. The particular function of flexor longus is claw protrusion. Operation of the reflex in quadripedal progression would have the effect of removing claw protrusion from obligatory association with the extensor phase of the reflex step.

Under the experimental conditions the foregoing reflex effects exhibit no sign of reciprocal action on antagonists.

Concerning afferent pathways the following conclusions may be drawn:

1. Deep and cutaneous nerves of the forelimb on stimulation yield the same reflex result.
2. Group I (myotatic reflex) afferent fibers do not have demonstrable long spinal reflex function.
3. A rather narrow band of the myelinated fiber spectrum, encompassing the lowest threshold cutaneous fibers (? alpha) and the lowest threshold Group II muscle afferent fibers is afferent for the inhibitory reflex of flexor longus digitorum.
4. Fibers afferent for the excitor reflexes lie among the higher threshold bands, including Group III-delta fibers.
5. Receptive field for the inhibitory reflex of flexor longus digitorum is limited to the extreme distal end of the forelimb.
6. Nerves from all parts of the forelimb contain fibers afferent for the excitor reflexes. (Authors' abstr.)

Metabolism of Brain Tissue Slices and Suspensions from Various Mammals.

1. The oxygen uptake rate of slices of cerebral cortex from various mammals is roughly inversely proportional to the tenth root of the average body weight of the individual adult of the species.

2. There is considerable variability in the respiration rate of tissue from different individuals within a species. This variability is not obviously correlated with the size of the animal.

3. There is considerable variability in activity between tissue slices from the same animal. Slices from dorsal areas respire more actively than slices from lateral areas.

4. Figures for respiration rates of brain *in vitro* and *in vivo* are compared and discussed.

5. Brain tissue slices are capable of active aerobic glycolysis. Brain suspensions, which are capable of active anaerobic glycolysis, show little aerobic glycolysis.

6. For comparison with abnormal tissue, the relative activities of oxygen uptake, respiratory carbon dioxide evolution, aerobic and anaerobic glycolysis of brain suspensions from various animals have been compared under standard conditions. The relative anaerobic glycolytic activity increases with increasing size of animal. (Author's abstr.)

Respiration and Glycolysis of Focal Epileptogenic Human Brain Tissue.

1. The average rate of oxygen uptake by samples of human focal epileptogenic brain cortex is not significantly different from the probable average oxygen uptake rate of normal human cortex.

2. The relative rates of oxygen uptake, carbon dioxide evolution, aerobic and anaerobic glycolysis of focal epileptogenic brain tissue are not significantly different from those of normal brain tissue. (Authors' abstr.)

Influence of Drugs on Response of a Crustacean Synapse to Pre-ganglionic Stimulation.

The effect of drugs on synaptic transmission in the crayfish was investigated by means of successive periods of high-frequency stimulation.

Amyl trimethylammonium caused a large increase in the duration of the response to such stimulation. This potentiated state was maintained for long periods without change.

Nicotine likewise caused a marked increase in the duration of this response, but this potentiation was soon followed by depression or block. This in turn was followed by recovery.

The effect of eserine resembled that of nicotine, but the initial potentiation was not as great. The addition of acetylcholine to a sub-threshold dose of eserine was without effect.

Hexyl dimethylamine in small doses depressed the synapse without initial facilitation. Depression by this drug was maintained for long periods without change. Larger doses caused rapid block.

No effect of arsenate, arsenite, cyanide, or fluoride was noted, either directly on synaptic transmission or on the action of nicotine. (Authors' abstr.)

Synaptic Fatigue and Chemical Mediators of Post-ganglionic Fibers.

In cats under anesthesia with nembutal the prolonged stimulation at different frequencies is not followed by a decrease of acetylcholine in the cholinergic fibers or of adrenaline in the adrenergic fibers. (Authors' abstr.)

Reticulo-spinal Influences on Stretch Reflexes.

The outstanding feature of the decerebrate preparation is an exaggeration of stretch reflexes of antigravity muscles, without irradiation.

In the decerebrate cat, appropriate regions of the brain stem reticular formation, excited electrically, exert pronounced facilitatory or suppressor influences upon stretch reflexes. These influences are exerted upon flexor or extensor activity alike, and hence are non-reciprocal or generalized.

Observations of vestibular and cerebellar influences upon stretch reflexes are also presented. The former is facilitatory and ipsilateral and is evoked with low frequencies of stimulation. The latter is suppressor and requires a high frequency of stimulation for its activation. (Authors' abstr.)

Excitation in Relation to Voltage Changes Along Nerve Surface.

Excitation of frog nerve was investigated in relation to voltage changes on the surface of the nerve induced by threshold rectangular current stimuli of various durations. It is assumed that voltage across the membrane in the extrapolar region is proportional to the voltage of the external fluid in accordance with the cable theory of core conduction.

For various durations of threshold current, curves of peak voltage as a function of extrapolar distance along the nerve surface were found to intersect at a locus corresponding to a region about 8 mm. distant from the cathode. In view of the very low magnitude of potential observed at such a great distance from the cathode, it is concluded that these findings do not offer a direct measurement of the minimal length of nerve which must be raised to a critical level of excitation prior to initiation of a propagated response.

In describing the time course of excitability at regions adjacent to the cathode a solution of the equation—

$$\frac{dx}{dt} = C(y)\,(P_0 - x) - k(x)$$

is found applicable as a first approximation. For this equation y is considered to be the concentration of a cation accumulated across the membrane capacity in direct proportion to the membrane voltage, and x is the fraction of a membrane constituent of original concentration P_0 which combines with y to form a complex which, when present in sufficient concentration, produces instability of some membrane component and hence leads to response of a nerve.

An electronic integrator is described which facilitates solution of the differential equation. (Author's abstr.)

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The Present Status of the Rorschach in Clinical and Experimental Procedures.

The Rorschach test has had an important and stimulating effect on the development of personality testing. Its value as a clinical instrument in the hands of experienced clinicians must be recognized.

The present status of research with the Rorschach places it in clinical use as a personal instrument. That is, its validity and clinical utility are dependent upon the person who uses it. It is, in its ordinary clinical use, primarily a subjective tool. There is little question that psychologists working in the field of classification of mental disease find it one of their best tools, particularly when they combine, consciously or unconsciously, their observations of the subject with their analysis of the test. The major caution in the use of the test in this setting is that the psychologist recognize that he does *not* have an objective tool, but simply another way of making observations such as he has in the interview, and that he treats his interpretations as *hypotheses*, not facts.

Caution must be exercised at this time in using the Rorschach as a known instrument in research against another unknown variable such as is done to study the effect of shock treatment, or the differences in personality under alcohol, or personality differences from one culture group to another. Too little is actually known about the Rorschach and the significance of responses in different cultural settings. The method may be suitable for studies of the relation of perception and motivation in the laboratory, where it is not necessary to assume a specific meaning for various types of responses.

If new experimental validation attempts are to be profitable, it appears that they must be carefully controlled for subjective bias. They must rely on the comparison of interpretations expressed in numerical ratings of variables with clearly defined referents with similar independent ratings of past or present behavior, rather than on classifications of disease entities. Perhaps most important is to remember that the Rorschach method involves many different hypotheses, not all of which are consistent with any one systematic approach to psychology. Researchers might well be concerned with testing individually the variety of principles involved in scoring and interpretation without feeling that the method as a whole must rise or fall with each study. (Author's abstr.)

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Studies in Epilepsy: Personality Pattern, Situational Stress, and the Symptoms of Narcolepsy.

From this study the following conclusions, perhaps applicable to the general problem of narcolepsy, may be drawn:

1. The life history and the personality pattern of the narcoleptic patient are characterized by conflict between emotional needs requiring relationships with others and denial of these needs expressed in a struggle for "independence."

2. Narcoleptic symptoms interrupt integrated activity in stituations evoking the life problems when behavior is elaborating into patterns consciously unacceptable to the patient.

3. Narcoleptic symptoms also occur when the patient's interest in the environment is minimal and tension from internal needs is absent.

4. Narcolepsy, as a disease, may then be viewed as a pattern of discontinuous organism-environment integration in which interruptions occur whenever intolerable distress arises in the course of the existing integration, or whenever chronic distress and immediate decrease of biologic tensions reduce the degree of integration below the waking level. (Author's abstr.)

Treatment of Psychoses with Bilateral Ablation of a Focal Area of the Frontal Cortex.

(1) Beneficial effects resulting from frontal lobe surgery are due to alteration of the affective responses.

(2) This effect appears only if areas 9 and/or 10 are encroached upon at operation.

(3) A large percentage of cases in which more than two large Brodmann areas or several small cortical areas are removed will show signs of deterioration in social behavior. (This also occurred in the authors' lobotomy cases, where large amounts of cortex were undercut.)

(4) Patients whose overt psychotic symptoms are removed by operation show essentially the same basic personality traits that were present before the illness began.

(5) In chronic psychotics affect becomes divorced from ideation to varying degrees. This seldom occurs in cases other than schizophrenics and manics. As this disassociation increases, the prognosis with operation becomes less favorable. (Authors' abstr.)

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A Psychometric Differentiation of Alcoholics from Non-alcoholics.

1. A study of alcoholics and non-alcoholics revealed many significant differences in responses to personality items.

2. These differences were utilized in the construction of a 72-item test for the psychometric differentiation of the alcoholics studied from the non-alcoholics studied.

3. The results of the scores made on this test indicated that the alcoholics consistently made the higher scores and the non-alcoholics the lower scores.

4. With the use of a critical score of 21 it was possible to make 79 per cent. correct predictions for the male group. A critical score of 26 made possible a higher per cent. of predictions for the female group.

5. The test possesses a reliability coefficient of ·94.

6. The validity of the test was established, for the alcoholic and the non-alcoholic groups used in this study, by selecting highly diagnostic items, establishing high predictability, demonstrating statistically significant differences of mean scores, and by showing that alcoholics consistently made the higher scores and non-alcoholics consistently the lower scores.

7. It was not established that this test could differentiate alcoholics from non-alcoholic clinical deviants.

8. A subjective analysis of the questionnaire items resulted in the recognition of seven characteristics in alcoholics which pointed to the presence of neurotic and psychopathic traits. The seven traits noted were: Anxiety, depressive fluctuations, emotional sensitivity, feelings of resentment, failure to complete social objectives, feelings of aloneness, and poor interpersonal relationships.

9. It is suggested that further studies be carried out in which "pure" groups will be compared on this 72-item test. By this is meant the comparison of male alcoholics free of neurotic and psychopathic traits with male alcoholics who may be psychoneurotic or psychopathic. Alcoholic psychopaths should be compared with non-alcoholic psychopaths, alcoholic neurotics with non-alcoholic neurotics,

and so forth. Similarly all the normal categories could be compared, e.g. normal abstainer versus normal social drinker; and normal groups with non-normal ones.

It is believed that the 72-item test developed may provide an exploratory technique for such studies. This test has been named "The Manson Evaluation," and will be available to professional workers. (Author's abstr.)

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1. Anatomy, Physiology and Biochemistry.

Influence of Anoxemia on the Appearance of Toxic Properties in Saliva. Krasnovskaya, L. A., and Efimov, V. V. [*Byull. Ekshptl. Biol. Med.*, **24**, 104–5 (1947).]

In human experiments at simulated altitudes of 1,500–5,000 m. the toxicity of saliva was determined by the contractile activity of a fresh frog muscle in physiol. solution at 30°, in terms of time of immersion. The normal curve is a rectangular hyperbola (total time 0·5 hour). At elevation of 5,000 m. definite toxic properties are apparent in the saliva; slight toxicity is apparent at 4,000 m. elevation. The exposure to low pressure lasted 30–40 minutes in each case.

G. M. Kosolapoff (Chem. Abstr.).

Canine Epilepsy Caused by Flour Bleached with Nitrogen Trichloride (Agene). I. Experimental Method. Silver, M. L., Zevin, S. S., Kark, R. M., and Johnson, R. E. (Univ. of Illinois, Chicago). [Proc. Soc. Exptl. Biol. Med., **66**, 408–9 (1947).]

Methods of preparing the experimental rations are described. Separation of the gluten from the fat-free agene-treated flour showed that the convulsive activity was retained in the protein fraction. Casein treated with agene also produced convulsions in dogs. The experimental diets did not produce convulsions in monkeys, but the monkeys developed tremor of the extremities and weakness of the hind limbs, which persisted for weeks after the experimental diet was discontinued.

II. Role of Amino Acids. Silver, M. L., Monahan, E. P., and Klein, J. R. [Ibid., 410–12.]

When an amino acid mixture approximating the composition of gliadin is treated with NCl_3 gas (agene) it is so altered as to make it convulsant for dogs when injected intravenously. L. E. Gilson (Chem. Abstr.).

Turnover of Phosphate in the Pineal Body Compared with that in Other Parts of the Brain. Borell, U., and Orstrom, A. (Wenner-Gren's Inst., Stockholm). [Biochem. J., **41**, 398–403 (1947).]

The pineal body has the highest turnover of radioactive P of any portion of the rat brain. In the pineal the P^{32} changes occur in two ways; a rapid turnover of P^{32} which chiefly involves carbohydrate phosphate esters, and a slow turnover involving phospholipides and nucleic acids. A marked increase in the P^{32} turnover of the medulla oblongata occurs following extirpation of the eyes.

S. Morgulis (Chem. Abstr.).

Chemical Nature of the Fatty Acids of Brain and Spleen Sphingomyelin: Occurrence of Saturated and Unsaturated Sphingosines in the Sphingomyelin Molecule. Thannhauser, S. J., and Boncoddo, Nicholas F. (J. H. Pratt Diagnostic Hosp., Boston). [J. Biol. Chem., **172**, 141–7 (1948).]

Crude sphingomyelin (16 gm.) obtained from the ether-insoluble brain lipide fraction by fractionation with glacial HOAc-acetone mixture was suspended in water first and then in 320 c.c. of 0·25 N NaOH and shaken for 4 to 5 days. After acidification with glacial AcOH the mixture was left overnight in the cold. The precipitate which resulted was filtered, washed with acetone, and extracted with ether (Soxhlet) for 2 to 3 days. The contents of the thimble were taken up in petr. ether-MeOH (9:1) and filtered. The filtrate was concentrated and the phosphatide precipitated with excess acetone. The dried precipitate was dialyzed and was filtered after addition of acetone and dilute HCl. By running a petr. ether-MeOH solution of this precipitate through a column of Al_2O_3 traces of cerebrosides were removed. The sphingomyelin was recovered from the concentrated solution by precipitation with acetone and recrystallization from a mixture of hot EtOAc (800 c.c.) and MeOH (8 c.c.). Brain sphingomyelin free of hydrolecithin analyzed 3·28 per cent. N, 3·76 per cent. P. It is a white crystal substance, soluble in benzene, warm alcohol, and hot EtOAc, insoluble in ether and acetone. It discolors at 190–5°, m. 212–213°, $(\alpha)\frac{22}{D} = +6{\cdot}25°$ (4 per cent. solution in $CHCl_3$–MeOH (1:1)); iodine number 42·5. From an acid hydrolyzate of brain sphingomyelin, stearic, nervonic, and lignoceric acids in the approximate proportions of 2:2:1 were isolated as well as sphingosine sulfate and dihydrosphingosine sulfate. Pure spleen sphingomyelin is a white crystal substance soluble in benzene, warm alcohol, hot EtOAc, insoluble in ether and acetone, m. 217° $(\alpha), \frac{22}{D} = +6{\cdot}25°$ (4 per cent. solution in mixture of $CHCl_3$–MeOH 1:1), iodine number 33·5. Upon acid hydrolysis, lignoceric and palmitic acids in 1:1 proportion and sphingosine sulfate were isolated. The iodine number of sphingosine from brain and spleen indicates that sphingomyelin consists of saturated and unsaturated sphingosine, in analogy to the composition of the cerebrosides. W. H. Fishman (Chem. Abstr.).

Isolation and Identification of Hydrolecithin (Dipalmityl Lecithin) from Brain and Spleen. Thannhauser, S. J., and Boncoddo, Nicholas F. (J. H. Pratt Diagnostic Hosp., Boston). [*J. Biol. Chem.*, **172**, 135–9 (1948).]

The procedure for the isolation of hydrolecithin (I) from beef lung (*C.A.*, **41**, 3159*b*) has been applied to the lipides of brain and spleen. The large amounts of cerebroside (II) present in brain (but not in lung or spleen) are removed by prolonging the Me_2CO extraction to 3 days at 60°, and by precipitating the (II) still present in the petr. ether solution with MeOH before concentrating the solution of (I). The yield of (I) from 25 lb. of beef brains was 4 gm., m. 238–40°; no depression in mixed m.p. with (I) from lung; iodine number 5·65. Hydrolysis of 2·5 gm. (I) by refluxing for 4 hours with saturated aqueous $Ba(OH)_2$ gave 2·07 gm. crude Ba salt (III). Esterification of 2 gm. of (III) in 5 per cent. H_2SO_4 in MeOH and extraction of the Me ester (IV) with petr. ether gave, after evaporation, 1·25 gm. (IV). (IV) distilled at 0·002 mm. at 94–6°. The free acid obtained from (IV) proved to be palmitic acid. Analysis of the filtrate from the alkali hydrolysis for choline and Ba glycerophosphate showed that (I) from brain is identical with (I) from lung. The (I) from spleen was found, by mixed m.p., to be identical with that from lung and brain. J. P. Danehy (Chem. Abstr.).

Vitamin B_1 and the Transmission of Nerve Impulses. Penas, Jose Bautista de las, and Francoli, Jose Luis Fernandez (Catedra farmacol. exptl., Madrid). [*Farmacoterap. actual (Madrid)*, **4**, 707–16 (1947).]

A theoretical review and discussion. A. E. Meyer (Chem. Abstr.).

Neurocerebral Paralysis Due to o-Tritolyl Phosphate Poisoning. Elsaesser, K. H. (Univ. Halle, Ger.). [*Z. ges. inn. Med.*, **2**, 749–54 (1947).]

Three cases of o-tritolyl phosphate poisoning are described in minute detail. One of the patients gave birth to a child about 4 months after the poisoning. The child also exhibited typical symptoms of poisoning and died 6 weeks after birth. The source of the poison could be traced to a poppy-seed cake. The poppy seeds, after oil extraction with trichloroethylene and removal of the solvent, had been carried for 10–12 hours in an Igelit bag. The latter is a rubber-like material which contains as a softener 30–40 per cent. of mixed tritolyl phosphates, only the ortho-isomer of which is poisonous. Bruno Vassel (Chem. Abstr.).

Influence of the Autonomic Nervous System on Intestinal Absorption of a Hypertonic Solution of Glucose (in Cats). Huidobro, F., Valdés, R., and Dávila, M. (Catholic Univ. Chile, Santiago). [*J. Pharmacol. Exptl. Therap.*, **92**, 336–44 (1948).]

The changes in volume and the absorption of glucose from 4 c.c. of a 10 per cent. solution of glucose placed in a loop of intestine about 16 cm. long with intact circulation was studied in cats anesthetized with nembutal. Normally there is an increase in volume with a later decrease, while the glucose is absorbed rapidly during the first few minutes and later more slowly. Atropine (injected intravenously) prevents much increase in the original volume, but does not affect glucose absorption. Prostigmine or ergotamine (injected intramuscularly) increases the volume of solution significantly; prostigmine does not affect glucose absorption, but ergotamine retards it. Stimulation of the splanchnic nerve in cats with intact adrenals does not affect volume or absorption, but in the absence of the adrenals it accelerates absorption of glucose. Acute section of the abdominal vagi also accelerates glucose absorption. Stimulation of the vagi causes an increase in solution volume and a decrease in absorption rate.

L. E. Gilson (Chem. Abstr.).

Significance of Vitamin E in the Development of Some Pathological Processes in the Nervous System. Mittel'shtedt, A. A. [*Nevropatol. i Psikhiat.*, **17**, 63–7 (1948).] G. M. Kosolapoff (Chem. Abstr.).

Distribution of Ascorbic Acid in Autonomic Ganglia and its Alteration in Experimental and Pathologic States. Sulkin, N. M., and Kuntz, Albert (St. Louis Univ. School of Med., Missouri). [*Anat. Record*, **101**, 33–47 (1948).]

The ascorbic acid content of autonomic ganglia has been measured using acidified $AgNO_3$. The $AgNO_3$ appeared as granules in the fixed tissue. The ascorbic acid was found in both the ganglion cells and the neurological supporting cells in the autonomic ganglia of the cat, guinea-pig, rabbit and man. In the guinea-pigs the amounts found varied with the content in the diet. On deficient diets a decrease in the autonomic ganglia was observed. W. E. CORNATZER (Chem. Abstr.).

Carbonic Anhydrase in the Brain of Birds Born Self-sufficient and Those Born Non-self-sufficient. Pigareva, Z. D. [*Doklady Akad. Nauk S.S.S.R.*, **60**, 185–9 (1948).]

Chickens and rooks were used as representatives of the types of 2 birds. In adult birds maximum carbonic anhydrase activity is found in the cerebral hemispheres and cerebellum. Rooks have consistently higher level of the enzyme in the brain tissue than the chickens; almost no difference was found in the spinal cord. In chickens the enzyme level grows gradually, starting with the embryo, and adult values are found early after hatching. In rooks the enzyme activity is at embryonic level as late as 3 weeks after hatching, then leaps upward sharply (most noticeably in cerebellum) and increases 6-fold over a 20-day period, reaching 50 per cent. of adult level at 45 days, as determined in the cerebellum and similarly in cerebral cortex. In the spinal cord there is little difference between the young of both birds, and only after 15 days does the rook begin to have higher levels than the chicken. The enzyme level and activity of the bird after birth are correlated. Results are given graphically. G. M. KOSOLAPOFF (Chem. Abstr.).

Effect of Central Nervous System Depressants on the Emptying Time of the Human Stomach. Northup, David W., and Van Liere, Edward J. (*West Virginia Univ., Morgantown*). [*J. Pharmacol. Exptl. Therap.*, **93**, 208–9 (1948).]

The effect of therapeutic doses of chloral hydrate α-bromo-isovalerylurea (bromural), Na pentobarbital, and paraldehyde on the motility of the human stomach was studied. Consistently increased motility was found only with Na pentobarbital, indicating that sedation is not the principal factor responsible for the decreased emptying time seen with central nervous system depressants, such as Na amytal, previously reported. L. E. GILSON (Chem. Abstr.).

The Oxidation Mechanism of the White Matter of the Central Nervous System. Huszak, Istvan. [*Acta Chem. Scand.* (1), 813–17 (1947) (*in German*).]

The O activated systems of the white (I) and gray matter (II) of the central nervous system are different. (II) contains the Warburg-Keilin Fe-containing catalytic system, which is absent in (I). (I) contains approximately the same quantities of Fe and Cu, whereas the Fe is greater in (II). The O uptake (respiration) of (I) is checked by KCN or CO. Na diethylthiocarbamate strongly inhibits (I) respiration. These results indicate that the Cu-protein complex plays a large part in the catalytic O transport in (I). BERNARD KLEIN (Chem. Abstr.).

The Relation Between Starvation, Metabolic Acidosis and Convulsive Seizures in Rats. Davenport, Virginia D., and Davenport, Horace W. (*Univ. of Utah School of Med., Salt Lake City*). [*J. Nutrition*, **36**, 139–51 (1948).]

The electroshock threshold of rats increases as their body weight increases. If the caloric intake is retricted, it falls significantly, and it rises abruptly to normal when the restriction is removed. Supplemental administration of vitamins of the B complex or of agar to rats having low threshold as a result of restricted caloric intake has no effect on it. Administration of carbohydrate, fat or protein to rats having low threshold as a result of caloric restriction raises it, while administration of fat to normal rats lowers it. The threshold may either rise or fall when mild metabolic acidosis is produced by starvation or fat feeding. Mild metabolic acidosis produced by NH_4Cl has no effect on the threshold, but extreme metabolic acidosis raises it. W. B. ESSELEN, jun. (Chem. Abstr.).

Glycolysis of Brain Preparations: IV. Meyerhof, Otto, and Wilson, Jean R. (*Univ. of Penna., Philadelphia*). [*Arch. Biochem.*, **17**, 153–69 (1948); *cf. C. A.*, **42**, 233*f*.]

Glucose is more rapidly glycolyzed than fructose with rabbit-brain extract if the concentrations of adenosinetri- (I) and adenosinediphosphates (II) in the medium are low. The differences in rates could be eliminated by the addition of (I) or by keeping (II) and free sugar at a high concentration. The chief reason for differences in glycolysis rates observed between rabbit brain extracts and homogenates is the presence of apyrase, which is bound to the structural elements. With 2–6 γ of labile P from (I) the rate of glucose and fructose turnover is about the same as with living tissue. With a water extract of acetone-defatted and dehydrated rabbit brain, in which most of the apyrase was destroyed, hexose monophosphate is metabolized rapidly (one hexose monophosphate molecule was glycolyzed for each 2·5 molecules which were converted into hexose diphosphate). Phlorizin inhibits the transphosphorylation between phosphopyruvate and (II). Octyl alcohol and phenylurethan inhibit hexokinase and phosphohexokinase. Octyl alcohol does not inhibit apyrase. VERNON L. FRAMPTON (Chem. Abstr.).

Distribution of Glutamic Dehydrase in the Central Nervous System. Trampetti, Giovanni, and Vantaggi-Cozzari, Luciana (Univ. Perugia, Italy). [Boll. soc. ital. biol. sper., **23**, 1109–10 (1947).]

Suspensions of a mash of gray and white matter of the brains of sheep, cattle and dogs exerted an enzyme action on glutamic acid, cleaving it into α-ketoglutaric acid and NH_3. This enzyme was present in larger amounts in the gray matter than in the white. HELEN LEE GRUEHL (Chem. Abstr.).

A Lipide Anticoagulant from Brain Tissue. Physiochemical Characteristics and Action in vitro and in vivo. Tocantins, Leandro M., Carroll, Robert T., and McBride, Thomas J. (Jefferson Med. Coll., Philadelphia, Pa.). [Proc. Soc. Exptl. Biol. Med., **68**, 110–17 (1948).]

Two methods for separating a heat-labile lipide inhibitor of blood coagulation from acetone-dried brain tissue are described. The substance is of waxy consistency, readily soluble in Et_2O, MeOH, $CHCl_3$, CCl_4, C_6H_6, pyridine, glacial AcOH and warm EtOH, insoluble in Me_2CO and cold EtOH. It is not affected by oxidation or drying at room temperature. In a still impure form it m. 182–200°. A 10 per cent. solution in 0·85 per cent. aqueous NaCl has a pH of 6. It gives negative Molisch and protein tests. It differs in potency and other respects from similar known anticoagulants. It has a marked antithromboplastic activity, especially against homologous brain extracts in homologous plasma. It is weaker than heparin *in vitro* but has a more lasting effect than heparin *in vitro*.

L. E. GILSON (Chem. Abstr.).

A Laboratory Test for the Virus of Poliomyelitis. Lepine, Pierre R. (Inst. Pasteur, Paris). [Science, **108**, 134–5 (1948).]

Mice are inoculated with a concentrate of material supposedly infected and subsequently inoculated 2 days later with active Lansing mouse-adapted virus. Three out of five of these mice show temporary to permanentprotection (in a positive test), as contrasted with death of four out of five control animals on the 10th–11th day. Tests were made satisfactory with cord material from monkeys and with fecal material from patients. Extracts from normal human feces or cord material inactivated by heating showed no protective action.

WALTON J. SMITH (Chem. Abstr.).

Brain Excitability in Pyridoxine-deficient Rats. Davenport, Virginia D., and Davenport, Horace W. (Univ. of Utah School of Med., Salt Lake City). [J. Nutrition, **36**, 263–75 (1948).]

The electroshock thresholds (I) of rats mildly deficient in pyridoxine rises significantly within 5 hours after the rats are injected with pyridoxine. Cellular hydration reduces (I) to a similar extent in normal and pyridoxine-deficient rats. The concentrations of H_2O, Na, K and Cl in the brain and blood plasma and of lactic and pyruvic acid in the blood are the same in pyridoxine deficient and control rats. Both types of rats have a very mild degree of metabolic acidosis. When extra tryptophan is added to the diet of rats mildly deficient in pyridoxine, the signs of deficiency are intensified and there is a fall in (I). This fall can be reversed within 5 hours by the injection of pyridoxine. Xanthurenic acid when injected into normal rats has no effect on (I) or maximum seizure pattern. Feeding extra glutamic acid to rats mildly deficient in pyridoxine causes (I) to rise. Rats more severely deficient in pyridoxine show a slower rise in (I) after injection of pyridoxine, but if the animals have been fed extra glutamic acid for 6 days they respond to injected pyridoxine as rapidly as do mildly deficient rats. It is suggested that the maintenance of normal transaminase activity is essential for those tests of normal brain activity employed in this study.

W. B. ESSELEN, jun. (Chem. Abstr.).

Biochemical Development of the Chick Embryo Brain. Comparison of the Different Fractions of the Acid-soluble Phosphorus. Mandel, P., Bieth, R., and Stoll, R. (Univ. Strasbourg, France). [Compt. rend. soc. biol., **141**, 1260–1 (1947) ; *cf. C. A.,* **42**, 1343*c*.]

Chick embryo brains were analyzed quantitatively after 10, 13, 16 and 19 days of incubation. The phosphoric esters remained about constant, but there was a rapid increase in creatine phosphate and decrease in pyrophosphate P between the 13th and 16th day ; this seemed to coincide with the period of rapid myelinization.

L. E. GILSON (Chem. Abstr.).

Additional Investigation of the Variations in Neuro-muscular Excitability Caused by Atmospheric Depression in the Animal. Chauchard, B., and Chauchard, P. (École pratique Hautes-Études, Paris). [Compt. rend. soc. biol., **142**, 6–7 (1948) ; *cf. C. A.,* **42**, 1645*c*).]

The decrease in chronaxia at simulated altitudes of 4,000–8,000 m. is discussed.

L. E. GILSON (Chem. Abstr.).

Mode of Intervention of the Nervous System in the Action of Morphogenic Hormones. Champy, C., Demay, M., and Samson, R. (Univ. Paris). [Compt. rend. soc. biol., **142**, 13–14 (1948).]

Tissues sensitive to hormones, especially sex hormones, are richly innervated by the sympathetic system. In tissue cultures and grafts the hormones have no effect unless fragments of the sympathetic network are present. Hence the nerves must play a part in hormone action, possibly through chemical mediators. In spayed guinea-pigs dilute acetylcholine solution was injected into the vagina and uterus 4 times daily for 10–30 days. The changes produced in the vaginal epithelium and uterine mucosa were similar to those produced by small doses of folliculin. In winter (period of sexual inactivity) one thumb of the frog, *Rana esculenta*, was kept moistened with acetylcholine solution for 10 days. A callosity or spur and pigmentation developed on the treated thumb similar to the changes normally occurring during the breeding season (May). The other thumb remained unchanged. Thus in two diverse cases a chemical mediator of the nervous system produced effects like those of a sex hormone.

L. E. GILSON (Chem. Abstr.).

Muscular Contraction. Dissociation of the Contraction Responses to Acetylcholine and Electric Stimulation by Potassium Ion. Scheiner, Hermann (Conservatoire des arts et métiers, Paris). [Compt. rend. soc. biol., **142**, 37–9 (1948) ; *cf. C. A.,* **42**, 5526*h*.]

Isolated frog rectus abdominis muscle treated with a solution of KCl loses its ability to respond to electric stimuli, but it responds about as usual to acetylcholine. Washing to remove K restores the sensitivity to electric stimuli.

Sensitization of Isolated Muscle to Acetylcholine by the Electric Current. Ibid., 40–2.

L. E. GILSON (Chem. Abstr.).

Phosphate Metabolism in the Hypophyseal-diencephalic System and Ovaries of Rats Determined by Means of P^{32}. Borell, U., Westman, A., and Orstrom, A. (Karolinska Sjukhuset, Stockholm). [Acta Physiol. Scand., **15**, 245–53 (1948).]

In the tuber cinereum of the rat the P turnover reaches a maximum during pro-estrus and then decreases markedly. In the adenohypophysis the turnover is much greater than in the tuber, but the maximum metabolic activity is again reached during pro-estrus. In the ovaries the greatest P turnover occurs during pro-estrus and di-estrus. This is regarded as evidence in favor of assuming that the hypophysis and diencephalon may be regarded as a functional unit.

S. Morgulis (Chem. Abstr.).

Experimental Histological Study of Neuroglia. Khlopin, N. G. [*Zhur. Obshchei Biol.* (*J. Gen. Biol.*), **8**, 473–93 (1947).]

Growth cultures, explanted or transplanted from optic nerve, lateral ventricle wall, spinal cord or other structures of embryonic or post-fetal rabbits were observed over periods of 4–50 days. In every case cells at centres of explants could be distinguished from astrocytes formed at tips of coarsely fibrous neuroglia. Optic neuroglia do differ, however, under conditions of extensive growth. Much of the prior literature on migration of neuroblasts and nerve cells in tissue cultures needs reinvestigation, since it neglects the histoblastic activity of neuroglia. All varieties of neuroglia and microglia have similar histoblastic capacity. When isolated they can change into macrophage-like cells which are not the same as macrophage of connective tissue. Julian F. Smith (Chem. Abstr.).

Current Problems of Nerve Action in the Higher Animals. Orbeli, L. A. [*Zhur. Obshchei Biol.* (*J. Gen. Biol.*), **8**, 407–20 (1947).]

The work of Ivan Petrovich Pavlov and his students in nerve physiology is reviewed, including the refutation of chemical antagonism in favor of physiological action and counter-action in explaining the Hering phenomenon when assimilation and dissimilation conflict in the peripheral nervous system.

Julian F. Smith (Chem. Abstr.).

Free Amino Acids in Cerebrospinal Fluid. Solomon, James D., Hier, Stanley W., and Bergeim, Olaf (*Univ. of Illinois, Chicago*). [*J. Biol. Chem.*, **171**, 695–700 (1947).]

Cerebrospinal fluids from 10 epileptic and 16 non-epileptic patients were assayed microbiologically for 11 individual free amino acids. Proteins present in the 40–80- c.c. samples were removed by heating 30 minutes at 100° at a pH of 4·7, and it was necessary to heat the protein-free filtrate for 2 hours longer on a boiling H_2O bath in order to remove some substance which otherwise inhibited the growth of the test organisms. Samples were adjusted to a pH of 6·8 and concentrated to a quarter their original volume, and were assayed by a procedure described earlier (*cf.* Hier *et al.*, *C. A.*, **41**, 2144*f*). For all 26 subjects average values in γ of amino acid per c.c. of spinal fluid were: Arginine 6 ± 1·4, histidine 1·7 ± 0·5, isoleucine 0·98 ± 0·5, leucine 1·4 ± 0·2, lysine 2·8 ± 0·8, phenylalanine 1·9 ± 0·7, threonine 2·8 ± 0·9, tyrosine 2·0 ± 0·7, valine 2·1 ± 0·5, methionine 0·4 ± 0·09, and cystine 1·8 ± 0·5. Free proline could not be detected. Ranges of values for epileptics were about the same as those of non-epileptics. Values obtained on a composite sample from adults (ages 45 to 60 years) were higher than those on a composite sample from children (2 to 12 years). Analyses on hydrolyzed spinal fluid protein were also done. The results (expressed as amino acid N in per cent. of total N) were: Arginine 5·4, histidine 5·2, isoleucine 1·8, leucine 6·2, lysine 13·1, phenylalanine 3·2, threonine 4·1, tyrosine 2, and valine 5. Although the pattern of free amino acids in blood plasma followed closely the pattern of amino acids in plasma proteins, the pattern of free amino acids in spinal fluid did not follow that of the amino acids in spinal-fluid protein. Precipitin reaction tests indicated spinal fluid protein was composed largely of serum albumin.

Carter D. Johnston (Chem. Abstr.).

Penetration of Radioactive Sodium and Chloride into Cerebrospinal Fluid and Aqueous Humor. Wang, Jun-Ch'Uan (*Univ. of Minnesota, Minneapolis*). [*J. Gen. Physiol.*, **31**, 259–68 (1948).]

By use of radioactive Cl^{38} and Na^{24} the rate of penetration across the blood-aqueous humor and blood cerebrospinal fluid barriers was measured following intravenous injection. The rate calculated as the time required for the labeled-ion concentration to reach 50 per cent. that of the plasma was found to be 34·3 ± 9 and 27·3 ± 9 minutes (aqueous humor), and 90 ± 6 and 95 ± 6 minutes (cerebrospinal fluid) for Cl^{38} and Na^{24} respectively. S. Morgulis (Chem. Abstr.).

Ultraviolet Absorption Spectrum of Human Cerebrospinal Fluid. Hack, M. H. (Univ. of Illinois Coll. Med., Chicago). [Biochem. J., **41**, 522–4 (1947).]

The ultraviolet absorption spectrum of human cerebrospinal fluid suggests the presence of at least 2 absorbing constituents, predominantly P-free protein and ascorbic acid. S. Morgulis (Chem. Abstr.).

Lipides in the Spinal Fluid in Pernicious Anemia. Lipemia, the Neural Component, Gastric Secretion, and Their Interrelation. Cassafousth, C. F., Cárrega, Brage, Diego, and Rivas, Lucio (Hosp. Durand, Buenos Aires, Arg.). [Semana med. (Buenos Aires) (1), 403–8 (1948); *cf. C. A.* **42**, 267*i*.]

The lipoids in the spinal fluid in pernicious aneomia are increased, especially the phospholipides, free, and esterified cholesterol. The neurological symptoms coincide with high phospholipide values. As the clinical picture improves with liver therapy, the level of all lipoidal constituents drops. Glossitis and gastric acidity also show parallel improvement. The blood lipoids behave differently in that during the reticulocyte response the phospholipides and cholesterol increase, while the total lipide content decreases. The various lipoid constituents show no parallelism in the blood or in the spinal fluid. A. E. Meyer (Chem. Abstr.).

Diagnostic Value of Comparative Examination of Spinal Fluid Composition at Various Heights of the Subarachnoidal Space. Mandel'boim, A. B. (Molotov Med. Inst., Alma-Ata). [Byull. Eksptl. Biol. Med., **24**, 359–64 (1948).]

A considerable increase of protein and positive globulin test are characteristic for tubercular spondylitis, sarcomatosis of the spinal cord sheath, and extra-medullary tumors. Accumulation of Ca in the lumbar fluid is observed in intra- and extramedullary tumors, sarcomatosis of the brain sheath and tubercular spondylitis. The same ailments also lead to lowered sugar level in the lumbar fluid ; the first two diseases also are characterized by increased lipoid level in the lumbar fluid. In all cases the Wassermann test is negative in both suboccipital and lumbar punctures. G. M. Kosolapoff (Chem. Abstr.).

Protein Content of the Spinal Fluid in Spinal Subarachnoid Block : A Report on 838 *Double Punctures. Wagner, Frederik F. (Serafimer-Lasarett, Stockholm, Sweden). [Acta Psychiatrica et Neurolog.*, **22**, 283–301 (1947).]

Spinal fluid proteins were determined by Bisgaard's HNO_3 method. There was no definite correlation between hyperalbuminosis and hydrodynamic black, but the parallelism was better in cases of intermedullary tumors, neurinomas and extradural tumors than of meningiomas and compressive processes. The protein of the lumbar fluid was more often increased than that of the cisternal, but there was no special significance to the ratio of the lumbar to cisternal protein.

H. L. Williams (Chem. Abstr.).

The Influence of the Blast Wave on the Biochemical Ingredients of the Blood and Cerebrospinal Fluid. Kometiani, P. A. [Trans. J. Beritashvili Physiol. Inst., **6**, 115–36 (1945) ; *Biol. Abstracts*, **21**, 807 (1947).]

An analysis was made of physical and chemical changes evoked by the blast wave in the blood and cerebrospinal fluid of dogs. Only slight changes were observed in the electrolyte content of serum and cerebrospinal fluid. The sugar content of these fluids, however, increases immediately after the blast. Hyperglycemia continues for 5–15 days. Alkali reserve and O capacity of blood decrease. Protein content and viscosity of plasma undergo no change or are altered only slightly. The chemical structure of oxyhemoglobin in erythrocytes does not change. M. F. R. (Chem. Abstr.).

Histochemical Demonstration of the Presence of Choline in Nerve Endings. Coujard, R. (Univ. Paris). [Compt. rend. soc. biol., **142**, 15–16 (1948).]

Tissue sections are treated with Reinecke reagent, then washed. Choline is precipitated as a pink compound, which is difficult to see under an ordinary microscope although it photographs well. The crystals are birefringent, and are readily seen with a polarizing microscope. L. E. Gilson (Chem. Abstr.).

Effect of Convulsant and Anticonvulsant Agents on Acetylcholine Metabolism (Activity of Choline Acetylase, Cholinesterase) and on Sensitivity to Acetylcholine of Effector Organs. Torda, Clara, and Wolff, Harold G. (Cornell. Univ. Med. Coll., New York, N.Y.). [*Am. J. Physiol.*, **151**, 345–54 (1947).]

Metrazole and picrotoxin increased acetylcholine synthesis; NaBr and trimethadione did not modify it, and scilliroside, digitoxin, camphor, morphine, strychnine, the barbiturates, and hydantoin and its derivatives decreased. Strychnine, morphine, scilliroside, metrazole, picrotoxin, and methylphenylethylhydantoin decreased the activity of cholinesterase; NaBr increased it. The acetylcholine sensitivity of striated muscle, used as an indicator of the acetylcholine sensitivity of effector organs in the cholinergic system, increased in the presence of metrazole, picrotoxin, morphine, and to a small extent in the presence of phenobarbital, diallylmalonylurea and Na isoamylethylbarbiturate; the acetylcholine sensitivity was not modified in the presence of trimethadione, Na barbital, and digitoxin, and was decreased in the presence of the other substances. The K sensitivity of striated muscle usually increased in the presence of lower concentrations of the substances used, and often decreased in the presence of higher concentrations. Although an accumulation of acetylcholine may precipitate convulsions, it is not the primary factor in their induction.

E. D. WALTER (Chem. Abstr.).

Action of Acetylcholine on the Peripheral Mechanisms which Support the Tone of the Blood Vessels. Rassalova, V. P. (Med. Inst. Frunze, Russia). [*Byull. Eksptl. Biol. Med.*, **24**, 95–7 (1947).]

In experiments with dogs (under morphine narcosis, 0·05 gm./kgm.) and cats (urethan narcosis 1 gm./kgm.) in which a rapid intra-arterial injection of 3–10 c.c. 20 per cent. NaCl is made to raise the blood pressure, followed by 0·8–1 mgm./kgm. eserine intravenously, then 4–8 minutes later by acetylcholine intravenously (0·00002–0·00005 gm./kgm.), there was observed either complete disappearance or great diminution of the pressor response to the NaCl. Eserine alone did not have this property. NaCl injection after acetylcholine administration is very feebly expressed and has only an extremely short duration. Acetylcholine, therefore, has a specific depressing action on the pressor reaction of blood vessels to irritation by certain chemical reagents; the effect may be described as a paralysis of the peripheral mechanisms which maintain the tone of the vessels.

G. M. KOSOLAPOFF (Chem. Abstr.).

Pharmacology and Biochemistry of Acetylcholine. Fuortes, Michelangelo G. F. (Univ. Torino, Italy), and Torre, Michele. [*Riv. patol. nervosa e mentale*, **60**, 352–73 (1942).]

After a review of pharmacology and biology data on acetylcholine (I), results are reported on experiments concerning the effect of (I) injections on the arterial pressure of dogs under barbituric narcosis, especially with regard to the intramuscular administration of (I). It was found that, under these circumstances, the action of (I) is not transient, but it lasts, on an average, 40 minutes (average intramuscular dose 5 mgm. per kgm. body weight).

C. SCANDURA (Chem. Abstr.).

Elimination of Action of Acetylcholine on Central Nervous System by Atropine. Babskii, E. B. [*Doklady Akad. Nauk S.S.S.R.*, **59**, 613–16 (1948).]

After atropinization the electric activity remains, but acetylcholine effect is eliminated. This argues against theories of acetylcholine action in manifestation of electric activity which have arisen recently. Dogs, given morphine (0·03 gm./kgm.), then ether narcosis, were trepanized and the chronaxia of the motor zone of the cortex was determined, using non-polarizing point Ag electrode; after establishment of the base-level, acetylcholine (25–100 γ/kgm.) was introduced; this was then followed by atropine (0·4 mgm./kgm.), and the effect on chronaxia was determined as usual. The results are given graphically. Similar experiments were also run on the visual brain segments of the frog.

G. M. KOSOLAPOFF (Chem. Abstr.).

The Effect of Acetylcholine on the Heart: An Electro-cardiographic Study in the Dog. Wilburne, M., Schlichter, J. G., and Simon, A. J. (Michael Reese Hosp., Chicago). [Arch. intern. pharmacodynamie, **76**, 63–71 (1948).]

Injection of acetylcholine into dogs caused a depression of the P-Q segment, of the S-T segment, a large T-wave, A-V block, and a long delay in the appearance of ventricular escape. This suggests direct action of acetylcholine on the ventricle. Auricular fibrillation also occurred. M. L. C. Bernheim (Chem. Abstr.).

High Serum-acetylcholine Concentrations in Pernicious Anemia and Their Reduction by Effective Therapy. Davis, John E. (Univ. of Arkansas School of Med., Little Rock). [Am. J. Digestive Diseases, **15**, 52–5 (1948); *cf. C. A.*, **41**, 2803*c*.]

The acetylcholine content of normal human serum was found to be 6·6 to 8·2 γ per cent. by biological tests. Five patients with pernicious anemia had 15 to 33 γ per cent. These values returned to normal when pteroylglutamic acid or liver extract was administered. W. E. Cornatzer (Chem. Abstr.).

Effect of Creatine Phosphate and Its Decomposition Products on the Acetylcholine Muscle Contraction. Minaev, P. F. (Acad. Med. Sci., Moscow). [Byull. Eksptl. Biol. Med., **24**, 290–2 (1947); *cf. C. A.*, **41**, 5206*d*.]

In experiments with frog stomach muscle it was shown that while immersion in 1 : 1,000–1 : 100,000 solutions of creatine phosphate does not produce contraction, subsequent immersion into acetylcholine solution gives considerably more pronounced contraction than in controls; at 1 : 10,000 concentration the sensitizing effect was maximum (36 per cent. increase). In a series of experiments with immersion in mixed solutions containing 1×10^{-6}–2×10^{-7} acetylcholine and the following substances listed below, the increased contractile activity is given in per cent. over control figures: Creatinephosphate (1×10^{-4}) 16 per cent.; creatine (1×10^{-4}) 0 per cent.; Na pyrophosphate and orthophosphate (1×10^{-4}) 0 per cent.; creatine and Na pyrophosphate simultaneously 14 per cent.; creatine and orthophosphate simultaneously 9·6 per cent. G. M. Kosolapoff (Chem. Abstr.).

Estimation of Acetylcholine Content of Nervous Tissue. Hobbiger, F., and Werner, G. (Univ. Wien, Austria). [Arch. intern. pharmacodynamie, **76**, 117–31 (1948).]

After freezing various parts of the frog central nervous system with liquid air, only 1/15 of the usual amount of free acetylcholine and 2/5 of the bound acetylcholine is found. This is due to loss accompanying thawing before eserine inhibits the esterase. Perfusion with eserine before grinding the tissue increases the yield of free acetylcholine 2 γ/gm. M. L. C. Bernheim (Chem. Abstr.).

Role of Acetylcholine in the Activity of Sensori-motor and Suppressor Areas of the Cortex. Beckett, Sibyl, and Gellhorn, E. (Univ. of Minnesota, Minneapolis). [Am. J. Physiol., **153**, 113–20 (1948).]

The topical application of acetylcholine, eserine and cholinesterase prepared from pancreas of dogs exerts the following effects on the cortex of the brain in cats and monkeys: Eserine with acetylcholine stimulates suppressor areas as indicated by temporary suppression or diminution of cortical electric activity, and by temporary elimination of the responsiveness of the motor cortex to electric stimulation as recorded by electromyograms. These substances also increase the responsiveness of the cortex to afferent stimuli as indicated by electrocorticograms. Cholinesterase diminishes cortical activity and the responsiveness to afferent stimuli. Acetylcholine is linked up with the process of excitation in motor, sensory and suppressor neurons on the cortex. E. D. Walter (Chem. Abstr.).

Acetylcholine Antagonists: A Comparison of their Action in Different Tissues. Elio, F. Javier de (Dept. Pharmacol., Oxford). [Brit. J. Pharmacol., **3**, 108–12 (1948).]

The relative local anesthetic potency, taking I as the value of procaine (I), for the compounds tested was: Cocaine (II) 7·4, amethocaine (III) 8·0, nupercaine

(IV) 10·0, quinidine (V) 1·5, trasentin--6H (VI) 1·0, and atropine (VII) 0·5. All 7 compounds diminished the action of acetylcholine (VIII) on the frog rectus in a suitable concentration. (VI and (VII) in low concentration increased the action of (VIII). The potency of the compounds on the rectus in relation to one another is in the same order as their local anesthetic potency, but (VI) is much more potent on the frog rectus than as a local anesthetic. All 7 compounds diminished the stimulant action of (VIII) on the rabbit intestine; (II) and (III) had the same activity as (I), (IV) was 4 times, (V) 6 times, (VI) 1,500 times and (VII) 3,000 times as active as (I). (I), (V), (VI) and (VII) depress the action of (VIII) on the heart, (II) is without action, and (III) and (IV) augment the action of (VIII) on the heart. All abolish the constrictor effect of (VIII) in the blood vessels of the rabbit's ear, (I), (III) and (IV) having the same activity, (V) weaker, (II), (VI) and (VII) stronger than (I). H. O. SINGHER (Chem. Abstr.).

Effects of Acetylcholine, Adrenaline, and their Antagonists (Atropine, Yohimbine) on Nerve Excitability in Rats. Chauchard, B., Chauchard, P., and Mazoué, Henriette (École pratique hautes-études, Paris). [Compt. rend. soc. biol., **142**, 131–2 (1948).]

Effects on chronaxia are discussed. L. E. GILSON (Chem. Abstr.).

Cholinesterase Kinetics in the Living Animals. Fuortes, Michelangelo G. F. (Univ. Torino, Italy) and Torre, Michele. [Riv. patol. nervosa e mentale, **60**, 374–80 (1942).]

Considering the time of action of intramuscularly injected acetylcholine and the permanence of the substance in the organism at least for the whole period of action, the authors conclude that the cholinesterase activity *in vivo* is much lower than that which has been found for tissue extracts. Acetylcholine duration in the organism is related to the quantity introduced and to the concentration achieved in the circulation. Therefore, " units of cholinesterase capacity " *in vivo* cannot be considered without relating capacity to the concentration of the initial substrate, and, on the other hand, results *in vitro* cannot be referred immediately to the living animal. C. SCANDURA (Chem. Abstr.).

Effect of Acetylcholine and of Inactivators of Cholinesterase on the Spontaneous Electrical Activity of Frog Nerve Centers. Artem'ev, V. V., and Babskii, E. B. [Doklady Akad. Nauk S.S.S.R., **59**, 393–6 (1948).]

Electric potentials of the visual sections of frog brain were examined either on animals with intact circulation and destroyed spinal cord, or on isolated heads. The active electrode was placed on the brain section, while the ground electrode was placed at brain section on the level of the smell centers; the potentials were examined by an oscillograph. The results are given graphically. Action of acetylcholine or its inactivators (eserine or prostigmine) was studied by application of suitably moistened filter-paper to the sight centers. Acetylcholine, without pre-eserinization, was used at 1×10^{-4}–1×10^{-5}; eserine was used at 2×10^{-5}–$2{\cdot}5 \times 10^{-6}$; prostigmine at 1×10^{-5}–2×10^{-6}. Acetylcholine alone shows its effect only at 1×10^{-4}–1×10^{-5} concentration and is manifested by increased amplitude of all oscillations. In combined acetylcholine-eserine application the effect starts at much lower level; at 10^{-8} acetylcholine enhances the oscillations; at higher concentrations the effect is decreased, and occasionally is absent entirely. Eserine and prostigmine (1–2×10^{-5}) enhance activity if the normal levels are fairly low; at high normal activity they have a suppressing effect. Acetylcholine thus acts as a regulator of activity level of the nerve center which liberates it.
G. M. KOSOLAPOFF (Chem. Abstr.).

Structure of Cholinesterases. II. Further Studies on the Electrophoretic Behavior of the Esterase in Horse Serum. Werner, G., and Kraupp, O. (Univ. Wien, Austria). [Arch. intern. pharmacodynamie, **76**, 1–12 (1948); *cf. preceding abstract.*]

From the activity of the enzyme concentrated at either anode or cathode, depending on the pH, it is concluded that it consists of two factors, which can be partially separated.

III. The Dissociation Constant of the Enzyme in Horse Serum. Kraupp, O., and Werner, G. [*Ibid.*, 13–24.]

By dilution of serum at various temperatures the existence of two enzymes with different dissociation constants is indicated.

M. L. C. Bernheim (Chem. Abstr.).

The Structure of Cholinesterase in Horse Serum. Kraupp, I. O., and Werner, G. (*Univ. Wien, Austria*). [*Arch. intern. pharmacodynamie*, **75**, 288–306 (1948).]

The intact enzyme has an isoelectric point at 5·2. It can be partially separated into a component having an active acid group with a pH about 6·0, and another having an isoelectric point between pH 3·0 and 5·0.

M. L. C. Bernheim (Chem. Abstr.).

A New Type of Cholinesterase. Zeller, E. A. (*Univ. Basel, Switz.*). [*Helv. Physiol. et Pharmacol. Acta*, **6**, C36–7 (1948) (*in German*).]

Cobra venom hydrolyzes acetylcholine and Et chloroacetate, singly or both together in the same solution. Both actions are inhibited by physostigmine, and the same enzyme is responsible for both actions. This is a new type of cholinesterase. Viper venom does not hydrolyze acetylcholine.

L. E. Gilson (Chem. Abstr.).

Preparation of True Cholinesterase. Scheiner, H. (*Conservatoire arts et metiers, Paris*). [*Compt. rend. soc. biol.*, **142**, 36–7 (1948).]

Blood corpuscles are washed 3 times with 0·9 per cent. NaCl solution, then hemolyzed with 5 volumes of distilled water. The stromata are removed by centrifuging, and dilute HCl is added to the clear red solution to a final concentration of approximately 0·01 N. The precipitate, which contains 95 per cent. of the original cholinesterase activity, is washed with successive portions of distilled water, centrifuging each time, until hemoglobin is removed. The residue, still containing 70–75 per cent. of the original enzyme activity, is dissolved by adding just sufficient 1 per cent. $NaHCO_3$ solution, then diluted as desired. At pH 8·0–8·6 the enzyme is not adsorbed from solution by fuller's earth or kaolin; at pH 6–7 it is adsorbed by kaolin. Upon elution from kaolin by dilute alkali only 20 per cent. is recovered. In 0·5 per cent $NaHCO_3$ solution the cholinesterase is completely inactivated by heating 3 minutes at 65°, and 20 per cent. destroyed in 30 minutes at 55°.

L. E. Gilson (Chem. Abstr.).

Cholinesterase. (1) *A New Method of Calculating Enzymic Activity. Arragon, G., and Sala, E.* (*Etablissement Roussel, Paris*). [*Bull. soc. chim. biol.*, **30**, 44–50 (1948).]

The usual methods of measuring cholinesterase activity are quite arbitrary. It should be more logical to express the activity in terms of the initial velocity as the angular coefficient of the tangent to the hydrolysis curve at its origin. This factor is independent of the concentration of the substrate and directly proportional to the concentration of enzyme. Examples and experimental data are given. The authors propose as a unit the quantity of cholinesterase necessary to make the angular coefficient of the tangent to the hydrolysis curve at its origin equal to 1, when the acetylcholine hydrolyzed is expressed in mgm. and the time in minutes.

(2) *Extraction from red corpuscles. Arragon, G., and Sala, E.* (*Etablissement Roussel, Paris*). [*Ibid.*, 51–4.]

Low temperatures are used throughout. The corpuscles are washed 4 times with 0·9 per cent. NaCl solution, then hemolyzed with distilled water saturated with $CHCl_3$. The solution is clarified by centrifuging, then a little diatomaceous earth is added, the pH is adjusted to 5·2–5·3 with HCl to precipitate the cholinesterase and the mixture is centrifuged. The sediment is washed 3 times with distilled water acidified to pH 5·3 with HCl. The enzyme is eluted from the washed residue with 4 successive portions of dilute NH_4OH of pH 8·0–8·2. The eluate contains 80–90 per cent. of the original activity. This crude preparation is further purified by adsorption on $Ca_3(PO_4)_2$ at pH 5.4 and elution with several portions of dilute NH_4OH of pH 8·2. The resulting dilute solution can be concentrated *in vacuo* at 37° and pH 7·4 with very little loss of enzyme activity.

L. E. GILSON (Chem. Abstr.).

Investigation of Cholinesterase in Human Blood Serums. Brecht, Karl (Univ. Tubigen, Ger.). [*Deut. med. Wochschr.*, **72**, 445–9 (1947).]

With a titration method based on the splitting of acetylcholine (I) by the cholinesterase (II) of blood at pH 8·4 and body temperature (37–38°), Brecht found a 300 per cent. variation in (II) in healthy men and women with a variation of 50 per cent. in the most common range. Muscle activity increased the (II) in blood as a counter-action to increased (I) formation. The (II) values in 2 cases of myotonia were relatively high, and in one case of myasthenia gravis (II) was low, but within the extreme ranges of values for healthy individuals.

GEORGE K. DAVIS (Chem. Abstr.).

The Influence of Local Disturbances of the Blood System on Blood Cholinesterase. Schummelfeder, Norbert (Univ. Greifswald, Ger.). [*Klin. Wochschr.*, **24**/**25**, 113–15 (1946).]

The effect of burning and freezing of the extremities on serum cholinesterase (I) activity of dogs was determined. (I) activity increased with each treatment, but values decreased when burning ceased and increased when freezing was discontinued. The latter effect is explained on the basis that the full effect of freezing does not occur until thawing begins. In the case of complete circulatory collapse from burning, (I) activity continued to increase. Results for whole blood were not clear.

JAMES F. HOGG (Chem. Abstr.).

Changes in Serum Cholinesterase Activity in Anaphylaxia. Heim, Fritz (Univ. Marburg, Ger.). [*Klin. Wochschr.*, **24**/**25**, 115–16 (1946).]

Serum cholinesterase activity of sensitized guinea-pigs was determined before and after release of shock. Activity was increased at 20 minutes after release of shock, but was decreased at 1 hour. After 2 hours inhibition was 15 per cent. Separate experiments showed that the shock liberated enough histamine (a concentration of 1 : 53,600 completely inhibited human serum cholinesterase activity) to explain the decreased activity.

JAMES F. HOGG (Chem. Abstr.).

Effects of Anticholinesterases on Direct and Indirect Stimulation of Striated Muscle. Lowe, Charles R., and Gesell, Robert (Univ. of Michigan, Ann Arbor). [*Am. J. Physiol.*, **153**, 355–63 (1948).]

A comparative study of the action of several anticholinesterases on muscle and nerve-muscle preparations of the frog was made: Physostigmine sulfate, prostigminemethylsulfate, diisopropyl fluophosphate (DFP), CO_2, and strychnine sulfate. All were dissolved in Ringer-Locke solution in various concentrations. There was a diminution of response of the muscle to stimulation with each cholinesterase.

E. D. WALTER (Chem. Abstr.).

Action of Adrenaline on Cholinesterase Activity. Belenkov, N. Yu (Acad. Med. Sci., Leningrad). [*Fiziol. Zhur.* (*J. Physiol.*), **34**, 223–7 (1948).

Action of adrenaline on cholinesterase activity in the brain of *Rana temporaria* was studied *in vitro*; the test object was the rectus abdominis muscle of the frog. Adrenaline in 10^{-7}–10^{-8} concentration hinders the cholinesterase activity; weaker solutions (10^{-9}–10^{-10}) do not affect the extent of the response to acetylcholine (10^{-6}–10^{-7}) of uneserinized transversely striped muscle; higher concentrations of adrenaline (10^{-6}–10^{-7}) gave an increased response in 53 per cent. of cases, a decreased response in 21 per cent. of cases, and no effect in 16 per cent. The concentrations are given in gm. per ml. of the solution used for the immersions.

G. M. KOSOLAPOFF (Chem. Abstr.).

2. Pharmacology and Treatment.

"Pellagragenic" Inactivity of 3-Indoleacetic Acid in the Rat. Rosen, F., and Perlzweig, Wm. A. (Duke Univ., Durham, N. Carolina). [Arch. Biochem., **15**, 111–14 (1947).]

3-Indoleacetic acid administered over prolonged periods to growing rats maintained on a low-protein, low-niacin diet failed to retard growth, impair food utilization, or produce any discernible reduction in the tryptophan-niacin transformation.
VERNON L. FRAMPTON (Chem. Abstr.).

Calcium Content of Brain and Muscle Tissues in Narcosis. Meglirskii, P. P., and Zinov'eva, M. T. (1st Med. Inst., Leningrad). [Byull. Eksptl. Biol. Med., **12**, 264–7 (1941); *cf. C. A.,* **41**, 6613*a*).]

The Ca contents of brain and muscle of guinea-pigs and rats were determined in the normal state and following 30 minutes Et_2O narcosis. The brain tissues were freed of blood before analysis by bleeding with a canule in the aorta, followed by washing with physiol. solution. In normal guinea-pig brain Ca varied from 17·7 to 32·52 mgm. per cent. and 24·8 to 124·05 mgm. per cent. respectively, after Et_2O narcosis. Rat brains showed a similar increase of Ca, from 37·82 mgm. per cent. average in the normal state, to 60·36 mgm. per cent. in the narcotic state. Muscle tissue also increased its Ca content in narcosis from 37·68 mgm. per cent. normal to 60·91 mgm. per cent. in the narcotic state.
G. M. KOSOLAPOFF (Chem. Abstr.).

Blood-Sugar Values in Poisoning with Hypnotics. Colldahl, Helge (Univ. Clinic Lund, Sweden). [Acta Med. Scand., **129**, 257–63 (1947).]

In some persons poisoned with hypnotics the blood-sugar level is low, although the usual hypoglucemic symptoms are not manifested because of the unconscious state. It is suggested that the administration of glucose is of great therapeutic importance.
S. MORGULIS (Chem. Abstr.).

Ability of Diisopropyl Fluophosphonate (DFP) to Produce Antidromic Activity in Motor Nerves. Masland, Richard L. (Univ. of Pennsylvania, Philadelphia). [Proc. Soc. Exptl. Biol. Med., **66**, 544–5 (1947).]

In cats DFP produced effects similar to those of eserine and neostigmine, presumably by inhibiting cholinesterase activity.
L. E. GILSON (Chem. Abstr.).

Effect of Various Anesthetics and Decerebration on the Stimulating Action of Carbon Dioxide on Respiration in Cats. Wang, S. C., and Nims, L. F. (Yale Univ.). [J. Pharmacol. Exptl. Therap., **92**, 187–95 (1948).]

Methods are described. The control ventilation and the sensitivity of the respiratory system to increased CO_2 are not appreciably altered by urethan (1 gm./kgm. intraperitoneally) or by midbrain decerebration. Nembutal (35 mgm./kgm. intraperitoneally) or chloralose (75 mgm./kgm. intravenously) markedly depresses the control respiration and the respiratory response to increased CO_2 in the inspired air.
L. E. GILSON (Chem. Abstr.).

An Electro-encephalographic Analysis of the Action of Amidone, Morphine and Strychnine on the Central Nervous System. Leimdorfer, A. (Univ. of Illinois, Coll. of Med., Chicago). [Arch. intern. pharmacodynamie, **76**, 153–62 (1948).]

The electro-encephalogram of the parietal and occipital lobes was determined in cats. Amidone-HCl (methadon) (3 mgm./kgm.) injected intravenously produces transitory diphasic spikes alternating with decreased voltage. Doses of 18 mgm./kgm. produce transitory high-voltage high-frequency discharges, and 22·5 mgm./kgm. abolishes all electric activity. Morphine sulfate (5 mgm./kgm.) administered subcutaneously produces a slight increase in the frequency, 40 mgm./kgm. intravenously causes a decrease in frequency, and another 40 mgm./kgm. abolishes electric activity. Strychnine (0·5 mgm./kgm.) by either route causes diphasic spikes in the spinal cord which are independent of those in the brain. In the mouse, elevation of the tail is a normal reflex stimulated by the three drugs at different loci in the central nervous system.
M. L. C. BERNHEIM (Chem. Abstr.).

Pain and Euphoria. Pharmacological Advances. Wolff, P. O. [*Ciencia e invest.* (*Buenos Aires*), **4**, 186–98 (1948).]

The pharmacology of metopon (methyldihydromorphinone), amidone (6-dimethylamino-4,4-diphenyl-3-heptanone) and synhexyl (1-hydroxy-3-n-hexyl-6,6,9-trimethyl-7,8,-9,10-tetrahydro-6-dibenzopyrane) is reviewed.

H. H. SZMANT (Chem. Abstr.).

Mechanism of the Hypochloremia from Barbiturate Narcosis in Mussels. Florkin, Marcel, and Douin, Jean (*Univ. Liége, Belg.*). [*Bull. soc. roy. sci. Liége*, **12**, 596–8 (1943).]

Blood Cl was measured at intervals after the injection of veronal Na. A decrease in Cl was observed when the mussels were kept in water, but not when they were maintained in a humid atmosphere after injection. It was concluded that the observed hypochloremia was the result of simple diffusion into the external medium.

FRED. H. SNYDER (Chem. Abstr.).

Neuro-muscular Block by Pilocarpine. Coppée, G. [*Bull. soc. roy. sci. Liége*, **12**, 468–70 (1943).]

The action of pilocarpine (I) was studied on isolated nerve-muscle preparations of the frog. Neuro-muscular transmission is blocked by (I) at a concentration of 1 : 1,000. The effect of (I) is increased rather than antagonized by atropine. Guanidine and veratrine counteract (I). Chemical excitability of muscle is not greatly modified by (I), the muscle retaining its sensitivity to K ions and to acetylcholine.

FRED. H. SYNDER (Chem. Abstr.).

Physiological Action of Parpanite and Curare Based on Self-experimentation. Heuscher, J. E., and Schoelly, M. L. (*Univ. Basel, Switz.*). [*Schweiz. med. Wochschr.*, **78**, 509–12 (1948).]

Intravenous injection of 12 mgm. of parpanite (I) produces after 2 minutes a slight haziness of vision. After 6 minutes there is hoarseness of voice, sensation of heat, reddening of the face, acceleration of pulse, palpitation and slight nausea. There is disturbance of voluntary breath control, and some difficulty in concentrating and in speaking. After 9 minutes there is a partial return toward normal. But after 13 minutes there is again accelerated pulse, irregular breathing, clouded vision and nausea. There is then improvement up to the 19th minute, when tachycardia and nausea appear. Following this there is general improvement, but complete return to normal only at the end of 2 hours. Parpanite is not suitable for electro-shock preliminary treatment. The action of (I) is upon several different parts of the nervous system, the peripheral, central and vagus systems. The muscular weakness produced by (I) responds only slightly to prostigmine. This differs from the action of curare (II), which acts on the striated fibers. Under the action of (II) a definite fatigue of the muscles results from repeated stimulation, but there is no total exhaustion as in the case of *myasthenia gravis* (III). Since (II) acts on the surface of the muscle this can be explained by supposing that in (III) there is a decrease in acetylcholine (IV), while under the action of (II) a normal amount of (IV) is present, but is acting on a smaller sensitive surface. The maximum action of (II) is reached in the 5–7 minutes after injection regardless of the size of the dose, but the duration is dependent on the dosage.

H. O. SINGHER (Chem. Abstr.).

Effect of Cardiazole, Camphor, and Insulin on the Bioelectric Activity of the Cortex and Subcortical Formations of the Large Brain. Lisitsa, F. M., Sarkisov, S. A., and Sereiskii, M. Ya. (*Brain Inst., Moscow*). [*Byull. Eksptl. Biol. Med.*, **23**, 262–7 (1947).]

The effect of convulsants and insulin on bioelectric activity of frog brain was recorded by means of a Simons oscillograph with 3- and 4-stage amplification; subsequent changes in bioelectric action were related to various brain structures. Cardiazole or camphor produces a 4-phase action; after a short latent period in which all biocurrents are somewhat inhibited, a phase of wave discharges of greater amplitude occurs which corresponds to that characteristic for epileptic seizures. These waves originate in and are discharged principally by the cortex, but earlier and more intense discharges appear in the hypothalamus as compared with cortical activity. However, simultaneously with the biocurrent from cortex and hypothalamus, a discharge is observed in subcortical regions. At the conclusion of the group of bioelectric discharges the biocurrents seem to be exhausted earlier in the cortex. In the 3rd, post-seizural phase a slow wave appears with individual discharges; later (4th phase) bioelectric activity ceases. The changes characteristic of the 3rd and 4th phases are generated only in structures showing marked changes in potential (cortex). It is possible to detect a separate discharge wave in the subcortical region by selective extinction of bioelectric activity in the cortex. Large doses (unspecified) of convulsants induce small differentiated bioelectric discharges in the cortex and subcortical regions, which begin and end in each structure simultaneously; sometimes a stage of rhythmic activity is set up analogous to that found in narconal narcosis. Insulin produced 5-phase bioelectric brain action. It sometimes caused an initial weak increase in α-wave amplitude in spontaneous activity and particularly in reponse to various stimuli followed by a similar weak depression in cortical activity. A rhythmic slow fluctuation in the occipital lobe is also observed in the 2nd phase; in the 3rd phase the α-waves almost disappear from the biocurrent of the cortex, and slow oscillations predominate. In the 3rd and 4th phases (absence of α-waves) the threshold of response to light and tactile stimuli rises. Tactile irritation of the skin or irradiation of the eye provokes wave discharges in the subcortical region bioelectrically characteristic for epileptic seizure. Insulin sometimes provokes true epileptic attacks in the animals at this stage. In the 5th phase complete absence of bioelectric response to light and exteroceptor stimuli develops in both cortical and subcortical formations. The changes in biocurrent described are closely connected with a fall in blood sugar as much as 60–53 mgm. per cent. Intravenous glucose gradually restores bioelectric actions to normal. H. J. OATFIELD (Chem. Abstr.).

Action of Phenamine on Conditioned Motor Reflexes in Monkeys (Macaca lapunder). Voronin, L. G., and Shirkova, G. I. [*Doklady Akad. Nauk S.S.S.R.*, **60**, 521–4 (1948).]

Phenamine (synthetic sympathicotropic alkaloid) administered at 0·03–3 mgm./kgm. level in 50 ml. of milk 40 minutes before the experiment, with a level movement by the monkey's hand as the response mechanism, showed repression of conditioned reflexes at doses over 0·18 mgm./kgm. and caused excitation in the animals. Since monkeys have a dead period in their conditioned reflex response in the middle of the night, experiments were also done in such a period; the drug removes the sleep condition, and in one specimen complete restoration of the reflex response was observed at 0·06 mgm./kgm. level, i.e. 5 times less than in man. The drug used at low levels, 0·12 mgm., appears to be optimum for the species, i.e., considerably lower than for man. The repressive action of large doses lasts for 24–48 hours. G. M. KOSOLAPOFF (Chem. Abstr.).

Curare-like Action of Polymethylene Bis-quaternary Ammonium Salts. Barlow, R. B., and Ing, H. R. (Oxford Univ., Eng.). [*Nature*, **161**, 718 (1948).]

Tubocurarine chloride is a bis (tetrahydroisoquinoline) alkaloid containing 2 quaternary N atoms. Its potency in blocking neuro-muscular transmission might be due in part to the presence of two cationic groups at some optimal distance apart. Salts prepared were polymethylene bis(trimethyl-) and bis(triethylammonium) dibromides with chain lengths of from 2–5 and 7–13 C atoms. In the bistrimethyl series the C_2 member was about twice as active as the tetramethyl member. The salts with C_3, C_4 and C_5 were only feebly active, but there was a progressive rise in activity from C_7 to C_9. Activity remained constant from C_9 to C_{12} and fell off slightly at C_{13}. In the bistriethyl series activity rose steadily from C_4 to C_{13}. None of these compounds was more than 40 per cent. as active as the tubocurarine chloride. ROSE BOYARSKY (Chem. Abstr.).

Curare-like Action of Polymethylene Bis-quaternary Ammonium Salts. Paton, E. D. M., and Zaimis, E. J. (Natl. Inst. Med. Research, London). [*Nature*, **161**, 718–19 (1948).]

In the rabbit head-drop test for neuro-muscular block the potency of straight-chain aliphatic α,ω-bis-trimethylammonium iodides increased from the ethylene derivative to the octamethylene derivative. The decamethylene derivative was most potent, 0·1 mgm. per kgm. of the iodide being required to produce head-drop compared with 0·25 mgm. per kgm. of the d-tubocurarine chloride. The potency varied with the test object. Peculiarly, d-tubocurarine chloride was unaltered in potency when given after the bis-quaternary salts, but the converse was not true.

ROSE BOYARSKY (Chem. Abstr.).

Tetraethylpyrophosphate in Myasthenia Gravis. Burgen, A. S. V., Keele, C. A., and McAlpine, D. (Middlesex Hosp., London). [*Lancet*, **254**, 519–21 (1948).]

Tetraethylpyrophosphate (I) was an effective substitute for prostigmin (II) in 3 patients with myasthenia gravis. In a single injection of 0·5 per cent. solution in propylene glycol, (I) was approximately half as potent as (II), but its effect persisted twice as long. It was more cumulative than (II), but less so than diisopropyl fluorophosphate. When given by mouth, 10 mgm. of (I) was equivalent to 100–150 mgm. of (II). For oral administration a 2 per cent. or 5 per cent. solution in propylene glycol was diluted quickly with H_2O to prevent rapid inactivation of the drug by H_2O. The oral maintenance dose of (I) ranged from 8 to 12 mgm. daily, given in 2–3 doses. The side effects of (I) are similar to those of (II).

B. R. MURRAY (Chem. Abstr.).

Effects of Electroshock on the Concentration of Iron in the Blood Serum. Ferroni, A., and Indovina, I. (Univ. Catania, Sicily). [*Boll. soc. ital. biol. sper.*, **23**, 988–90 (1947).]

In 24 mental patients the concentration of Fe in the blood serum usually decreased after *grand mal* convulsions induced by electroshock, but increased when electroshock induced the *petit mal* type of response. W. M. S. (Chem. Abstr.).

Stable After-effects of Electric-shock Therapy. III. Effect of the Electrically Induced Convulsion on Some Phases of Mineral Metabolism in Schizophrenics. Serezhskii, M. Ya., and Lando, L. I. (Ministry Health, Moscow). [*Byull. Eksptl. Biol. Med.*, **24**, 355–9 (1948) ; *cf. ibid.*, **23**, 1 (1947).]

Before the shock treatment the average blood levels in a variety of schizophrenics were : 3·4 inorganic P, 11·5 Ca, and 17·5 mgm. per cent. K. Immediately after the electric shock inorganic P rose by 18, Ca rose by 13 and K rose by 8·2 per cent. One hour after the shock inorganic P fell somewhat below the normal level and K and Ca fluctuated considerably. After repeated shocks the results obtained are indistinguishable from the immediate after-effects of a single shock.

G. M. KOSOLAPOFF (Chem. Abstr.).

Paralysis of Nerves by Weichigelit (o-Tritolyl Phosphate Intoxication). Elsaesser, K. H. [*Deut. Gesundheitsw.*, **3**, 168–70 (1948) ; *Suddeut. Apoth.-Ztg.*, **88**, 162 (1948).]

Tritolyl phosphate, containing approximately 30 per cent. of the ortho isomer, is used in the production of Weichigelit. Cases of poisoning resulting from use of Weichigelit for shoes, bags and wrapping of food are described. o-Tritolyl phosphate can be eluted from the plastic and absorbed by the skin, causing nerve paralyses, especially in the extremities. EDWARD H. SHEERS (Chem. Abstr.).

The Point of Attack of Morphine on the Respiratory Center. Fischlewitz, J., and Bucher, K. [*Experentia*, **4**, 196–7 (1948) (*in German*).]

The brain stem of a rabbit was cut at about the middle of the pons. When morphine was applied to the caudal portion below the cut there was an increase in expiratory vagal reflexes. When it was applied above the cut area, nearer to the brain, or when it was given intraperitoneally, no augmentation of vagal reflexes was produced. The authors believe that the vagal reflex augmentation produced in normal animals by morphine is due to the action of morphine in removing an inhibiting effect located in the pons. C. RIEGEL (Chem. Abstr.).

The Pain-alleviating Action of Cobra Venom. Gessner, O., and Demuth, W. (Univ. Halle, Halle a S., Ger.). [*Med. Z.* (1), 62 (1944) ; *Chem. Zentr.*(1), 142 (1947).]

Cobra venom was found to be less satisfactory than morphine as regards the reliability and the rapidity of the pain-alleviating action. Nevertheless, its use alone or in combination with analgesic substances of the pyramidone series is recommended in those cases in which morphine or other opiates cannot be used or are poorly tolerated. M. G. Moore (Chem. Abstr.).

Penicillin in the Cerebrospinal Fluid following Parenteral Penicillin. Boger, Wm. P., Baker, Richard B., and Wilson, Wm. W. (Philadelphia General Hosp., Pa.). [Proc. Soc. Exptl. Biol. Med., **68**, 101–6 (1948).]

Penicillin concentrations above 0·03 units/c.c. were found in human cerebrospinal fluid following intermittent intramuscular injection of 100,000 units in aqueous solution. Caronamide increased the plasma levels of penicillin after doses of this size, and thereby increased the amount entering the cerebrospinal fluid. Caronamide itself entered the cerebrospinal fluid only at excessively high plasma concentrations (87–110 mgm./c.c.). L. E. Gilson (Chem. Abstr.).

Effects of Amphetamine and Cocaine on Neuromuscular Function. Luco, J. V., Eyzaguirre, C., and Perez, F. (Catholic Univ. of Chile, Santiago). [J. Pharmacol. Exptl. Therap., **93**, 261–72 (1948).]

Cats anesthetized with nembutal were used in studying the effect of amphetamine (benzedrine) and of cocaine on action potentials of A fibers, on neuromuscular transmission and on the α waves of the A fibers. Amphetamine had a defatiguing effect during low-frequency stimulation, but it acted as a depressant during high-frequency direct or indirect stimulation (i.e. during intense activity of the contractile mechanism). It increased the response of denervated muscles to acetylcholine. It produced a contractile response in both normal and denervated skeletal muscles ; since this response was not accompanied by action potentials, it was a contracture. Amphetamine had a tachyphylactic effect on blood pressure, but not on muscular response. During indirect muscle stimulation, cocaine, like amphetamine, acted to increase or decrease response. The same effect was produced when a denervated or fully curarized muscle was directly stimulated. Increased response seemed to be related to the development of contraction fatigue. Cocaine in small doses increased the response of denervated muscles stimulated by acetylcholine ; large doses had a depressing effect. L. E. Gilson (Chem. Abstr.).

The Effect of Glutamic Acid on the Behavior of the White Rat. Hamilton, Hughbert C., and Maher, Eilleen B. (Temple Univ., Philadelphia, Pa., [J. Comp. Psychol., **40**, 463–7 (1947).]

The effect of a 275 mgm. supplement of glutamic acid to the regular daily diet of white rats was studied. The test animals showed greater activity during the exploring period, but no other superior behavior on the Maier 3-table " reasoning " test. E. R. Newton (Chem. Abstr.).